UNITED STATES NAVY

STRUCTURAL FIRE-FIGHTING MANUAL

1953

OPNAV INSTRUCTION 5560.7

NAVY DEPARTMENT
OFFICE OF THE CHIEF OF NAVAL OPERATIONS
WASHINGTON 25, D. C.

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DEPARTMENT OF THE NAVY

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ACKNOWLEDGMENT

The Chief of Naval Operations appreciates the fact that this Manual is the result of the collective experience of professional firefighters from cities, large and small, in all areas of the United States. Firefighters who served in the Navy as officers and enlisted men during World War II and those presently on active duty in the Navy, in addition to Navy civilian employees assigned to fire protection duty, contributed greatly to this publication. Their civilian background and experience, as well as full appreciation of fire protection problems at Naval Shore Activities, resulted in sound and reasonable recommendations for the basic standards and training procedures incorporated herein.

Organizations, agencies, associations, universities, industries, cities, counties, states and individuals concerned with the promotion, study and active participation in fire protection for the National Defense also have freely contributed their time and material for this publication. For contribution of material, particular mention is made of the International Association of Fire Chiefs, National Fire Protection Association, National Board of Fire Underwriters, Fire Engineering and its Editorial Staff, the University of Maryland, Oklahoma A&M University, the District of Columbia Fire Department, the City of Los Angeles Fire Department, Naval District Fire Marshals, Naval Activity Fire Chiefs and the Fifth and Twelfth Naval District Structural Fire Fighting Schools. To everyone who assisted in making this Manual possible the Chief of Naval Operations is grateful.

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DEPARTMENT OF THE NAVY

Office of the Chief of Naval Operations
Washington 25, D. C.

26 JUN 1953

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From: Chief of Naval Operations
To: Distribution List
Subj: United States Navy Structural Fire Fighting Manual
Ref: (*a*) Art 0204, par. 11, U. S. Navy Regulations
Encl: (1) Chapters I through VII
(2) Cross Reference Sheet

1. *Purpose.*—This Instruction promulgates the United States Navy Structural Fire Fighting Manual which is being reissued in the Navy Directive System.

2. *Cancellation.*—Chapter VI, Minor Extinguishment Practices, and Chapter VII, Fire Department Drills, United States Navy Structural Fire Fighting Manual, OPNAV–P415–106 of 15 January 1947 are canceled and superseded.

3. *Background.*—The United States Navy Structural Fire Fighting Manual, OPNAV–P415–106 of 15 January 1947 is presently under revision and will be reissued in the Navy Directive System. Since it is not feasible at present to issue a completely revised manual certain portions will be promulgated from time to time until the entire manual has been brought into the system. Therefore, those portions of the 1947 edition of the manual, which are not canceled by this Instruction or subsequent changes thereto, and which do not conflict with other current OPNAV INSTRUCTIONS remain effective until the entire Manual has been incorporated into this Instruction.

4. *Scope.*—This Manual is published by the Chief of Naval Operations in accordance with the provisions of reference (*a*) and is issued for the information and guidance of all personnel in the Naval Establishment concerned with matters of structural fire security. All instructions and directives contained in this Manual and changes thereto shall have the same force and effect as orders issued by the Chief of Naval Operations, but shall in no way alter or amend any provisions of the United States Navy Regulations or Navy Department General Orders.

5. *Distribution.*—Initial distribution of this Manual is predicated on the basis of one copy to each command concerned with structural fire fighting and fire prevention, one copy for the fire chief of each structural fire fighting organization and one copy for each fire company for use and study by personnel assigned thereto. Addresses are requested to assure that proper distribution is made as set forth above.

6. *Request for additional copies.*—Copies of this publication are limited in number and should be retained only at activities requiring same for training and drill purposes. Requests will be held to a minimum consistent with actual needs. Copies are not available for Navy distribution to organizations or persons outside the Naval Establishment. Organizations or individuals desiring copies of this Manual may purchase same from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

W. M. FECHTELER

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CHAPTER I

INTRODUCTION

0101. ORGANIZATION AND RESPONSIBILITY

1. Overall coordination of fire fighting and fire prevention for naval shore activities rests in the Office of the Chief of Naval Operations.

2. The Bureau of Yards and Docks is the technical bureau responsible for fire protection engineering and for the general development and formulation of structural fire prevention methods and measures at naval shore activities, including the design and installation of required facilities and equipment.

3. Commandants of Naval Districts and River Commands have responsibility for fire security inspections, fire fighting training and overall coordination of fire protection at all stations within the geographical limits of their districts except at stations under the Chief of Naval Air Training and the Commandant of the Marine Corps who have such responsibility for their stations. In this respect the Chief of Naval Air Training and the Commandant, Marine Corps utilize the services of the District Fire Marshals and Fire Protection Engineers in accordance with present policies.

4. The District Public Works Officer performs the functions listed under paragraph 2 and is responsible for conducting fire prevention inspections. In this connection District Fire Protection Engineers are retained to provide the necessary technical assistance.

5. The District Fire Marshal serving on the Commandant's Staff conducts fire fighting inspections and renders such other technical assistance as may be considered necessary by the Commandant in connection with the fire security responsibilities of his office.

6. Commanding Officers at Shore Stations have responsibility for day to day fire fighting and fire prevention at their activities. Commands shall request technical assistance of the District Fire Officers whenever the necessity or desirability for such assistance arises.

7. Where municipal fire departments are available they will be relied on to the greatest practical extent, but stations will ordinarily maintain, as a minimum, local units trained to conduct fire prevention inspections and extinguish minor fires and to handle large fires where municipal fire departments are not available.

8. Full time structural fire fighting organizations at stations should consist of civilian personnel, trained and experienced in fire fighting, wherever possible or practicable and military personnel should be utilized in addition as auxiliary firefighters.

9. The same standards of protection are applicable to extra continental activities insofar as possible.

0102. OBJECTIVE

1. The objective of the instructions which appear herein is to establish a coordinated policy for structural firefighter training and to standardize the methods and procedures in fire department training and drill evolutions.

0103. APPLICATION

1. The Department of Navy recognizes the importance of maintaining adequate fire safeguards at shore activities and every practicable measure to further that objective will be continued.

2. The value of the Navy's assets are about 5 times that of 8 of the largest corporations in the United States. It is imperative therefore, that every reasonable fire fighting and fire prevention precaution shall be taken in the interest of the National Defense. This can be effectively accomplished and maintained by "All Hands," civilian and military alike, understanding fully their responsibility in the Navy fire protection program and by their collective cooperation in assisting the organized fire protection forces.

3. The Navy's Structural Fire Fighting Forces vary at shore activities in accordance with the station's designated fire protection classification, i. e. extent of life hazard involved,

values to be protected, permanency of activity, operational status and strategic importance to the Navy. Even in considering these factors in determining the fire protection classification of an activity it is not intended nor is it economically feasible that the organized fire fighting force shall be self-sufficient at each activity except in certain isolated areas where reasonable outside aid is not available. Therefore mutual aid is approved and solicited wherever possible.

4. In view of the foregoing, the Navy's organized full time fire protection forces are limited in number. Accordingly it is necessary that Navy Fire Department personel provide maximum efficiency at minimum cost. Simplifying and standardizing training methods and procedures are highly important factors in effecting such a program.

5. Standardization of equipment, training and drill procedures have been recognized and frequently recommended by district fire marshals, naval activity fire chiefs and various Commands as essential for greater efficiency and economy in Navy fire protection Therefore, the drill evolutions contained herein are tried and proved practices of the fire service. They supersede the training suggestions of the U. S. Navy Structural Fire Fighting Manual OPNAV–P415–106, Chapters VI and VII, and henceforth become the Navy standard procedure and practice. Navy structural firefighting schools, naval district fire marshals and naval activity fire chiefs will adhere closely to the practices and procedures set forth herein.

6. Efficiency in fire fighting demands that every fireman be thoroughly familiar with all basic operations necessary in the handling of hose lines, ladders and equipment.

7. It is further necessary that each fireman be thoroughly familiar with all hose layouts, ladder operations and the use of all equipment of the company to which he is assigned.

8. The practices and procedures set forth herein are not designed nor intended to limit any person in the exercise of his judgment or initiative in taking the action a reasonable person would take in extraordinary situations.

9. Speed is important in all fire fighting operations. Speed however, does not necessarily indicate an efficient fire fighting organization. Regular training in the use and handling of equipment plus frequent drills in basic evolutions develop team work which ultimately produce the necessary speed to confine, control and extinguish fire. It cannot be overemphasized that a small body of men, well trained and drilled in fire fighting with team-like precision, can do more effective fire fighting than a group of men, double in number, who, lacking such training, would not only endanger their own lives, but also those of their coworkers through awkward and clumsy handling of ladders and hose lines. Sheer numbers alone offer no assurance of action. There is no substitute for training; drills, drills, and more drills—day and night—by a relatively permanent crew, though small in size, is the only method of assuring the prompt and decisive action that must follow a fire alarm.

10. Surprise drills occasionally ordered by commanding officers, security officers, inspection parties or other authorized personnel should not be construed nor listed as fire department training. The mere laying of several sections of fire hose followed by water at the nozzle in a few seconds, as clocked by an inspection officer, will not indicate the efficiency of a fire fighting company nor will it necessarily provide proof of the quality and quantity of training given. A surprise drill properly conducted by competent personnel indicates the effectiveness of the station fire bill and station orders, the fire department's prefire planning program, the alertness of auxiliary fire fighting crews, the fire chief's and company officers' ability to understand the planned fire fighting problem given on the fire ground, i. e. location and possible extent of simulated fire, life hazard involved if any, unusual conditions, etc. It also indicates the chief's ability to give the necessary orders to his subordinates to effectively carry out required operations to control, confine and extinguish the fire. Such a drill will provide a check on firefighter training; it will show the response and reporting of certain personnel designated by the station fire bill, e. g., public works, ambulance, auxiliary fire fighting crews, security officer, security guards, duty officer and others. However, caution should be exercised in conducting such drills to avoid a serious delay in response to a real emergency which delay might be occasioned by requiring all the fire hose to be laid out from all available equipment.

Chapter 2

TRAINING

0201. RESPONSIBILITY

1. Training in fire protection (fire fighting and fire prevention) at each naval activity is the responsibility of the station fire chief.

2. It has been long recognized that fire fighting, including fire prevention, is a science which requires a vast store of professional knowledge and skill. Accordingly, the qualified modern fire chief must have years of fire department experience, together with a requisite knowledge acquired by systematic study and training. His qualifications for and success as a Fire Chief are evidenced by the efficiency of the fire department he heads. Alert, enthusiastic and energetic fire fighters supervised by fire officers with an equal interest, usually denote a progressive fire department with a well planned training program under the direction of the fire chief.

3. The fact that one knows how to do a job does not necessarily indicate that he can teach it to others. Probably he cannot teach the job effectively unless he understands the fundamentals of teacher training. Such training for supervisory personnel in the modern fire department is now the rule rather than the exception.

4. The Navy maintains at many activities a Training Division in the Industrial Relations Department. Training specialists conduct classes for supervisory personnel in all departments. In these classes the student learns Job Analysis and Teaching Methods. Activity fire chiefs and other fire department supervisory personnel are urged to avail themselves of this training and apply the principles taught to the fire training program.

5. An excellent publication to assist in this program is TRAINING FIREMEN—AN INSTRUCTOR'S MANUAL IN FIRE SERVICE TRAINING, prepared by the School of Trade and Industrial Education, Oklahoma, A & M College and the State Board for Vocational Education Division of Vocational Trades and Industries, 1952, and published by A & M College Bookstore, Stillwater, Oklahoma. The Training Division of a Naval Industrial Relations Department printed a supervisory development pamphlet which is particularly applicable to the fire service. It is entitled "Training Is Your Business," and is quoted below for the benefit of all firefighter personnel.

0202. TRAINING IS YOUR BUSINESS

1. Don't Let Our Title Throw You

Probably our subject could be developed into a stylish sermon buzzing with high-powered theories and impressive generalizations but we believe that is exactly what you don't want. We think that you want straight talk—guide lines to help you meet your everyday operating problems. So we are going to strike directly at one of your major operating problems, your problem of getting maximum productivity out of each position. We are going to set down some principles that you can apply in determining when and how training can help you work up the efficiency of your unit.

2. You Are Not the Exception

Every supervisor has a training job to do. It is just impossible to conceive of any unit in our organization which is not faced by recurrent training needs. Every unit is subject to change in personnel, methods, functions, and workload, and these changes inevitably call for some amount of training. It cannot be assumed that careful training is unnecessary merely because the degree of change is limited. Experience has shown that the investment of a few minutes or hours of your time showing an employee how to adjust to any change in his duties or method of work is sufficient to bring large returns. Please get that.

3. Let's Get Down to Brass Tacks

a. At one time or another, you will have to meet these definite training responsibilities:

(1) Equipping new employees to function effectively on their jobs.
(2) Increasing older employees' effectiveness on their present jobs.
(3) Preparing employees for promotion and for greater versatility.
(4) Developing enthusiasm, understanding, and other elements of general "organization fitness."

b. These needs are common to every organization, both public and private. They must be met squarely, promptly, and intelligently. If any one of them is overlooked, purposely ignored, or ineptly attacked, we will find ourselves unable to function at an acceptable standard of effectiveness and economy. You cannot afford not to become training conscious.

4. Get Ready, Get Set

Chances are good that for one reason or another you will face the problem of breaking-in a new employee sometime soon. Resignations, reassignments, promotions, or increases in strength are always distinct possibilities. Further, it's an odds-on chance that an individual's prior education and experience will not entirely and exactly meet our needs. We come as close as possible in the selection process, but some supplemental training is always necessary to develop the new employee. It makes good sense to do some advance thinking and planning as to the kind of training you should provide.

5. Fragile—Handle With Care

a. We have about the same problem whether we are breaking-in an ex-tackle or an ex-campus queen. Most new employees are bewildered, apprehensive, sensitive. They all have much to learn. It requires care, tact, and intelligence to develop them into thoroughly acclimated and qualified employees. Every new worker needs to learn something about our organization as a whole. Inform him of the many rules and regulations which will govern his conduct and all the personnel policies, practices, and services which will so intimately affect him. Tell him about the aims, the purposes and the social value of our activity; the functions of its various parts; and how his job contributes to the total mission. The usefulness of the work he performs is important to his self-esteem. It will have a real bearing upon the interest and enthusiasm he feels in trying to do a good and conscientious job.

b. Next, he needs to learn the work itself. Of course, he does. A new employee is a liability until he becomes productive. He interferes with the routine of the unit; he occupies the time of others who are already productive. If he is allowed to drift for a period of time before planned job skills training is actually begun, this condition will become increasingly aggravated and his confidence in his ability to succeed on the job will be shaken. You can't put it off—start teaching him, pronto!

6. Turn on the Light—Evaluate

a. Training the new worker by no means satisfies our total training responsibility. Certainly, experience has proved to you that merely because an employee has been performing a job for a considerable period of time, it doesn't follow that he is doing it well. If he is doing a good job, there is the possibility that he could do even better. Take a moment to look at your workers. Try it now. Right now. How well are they actually doing—not collectively but individually? Who is doing better work than you can reasonably expect? Who cannot meet your standards? Watch each employee work; inspect his results. Ask yourself: "Is there anything he should be doing differently? What more does he need to know to do his job the best way?"

b. Often you will find that comparatively minor deficiencies are the stumbling blocks. An employee may be unaware of a few of the tricks of the trade, the sources of information on which he can draw, the logical approach to his problems. A thorough evaluation will spotlight most of the trouble.

7. Maybe He's Down—Not Out

a. Not too many substandard employees can be properly classified as hopeless cases. Don't be too quick to throw in the towel. A bit of coaching from the ringside, and some sound advice between rounds may be all that is needed.

b. Mediocre performance may mean that the employee was never taught to do his job better. Many employees have been assigned to duties after receiving only sketchy instructions. From that point forward, they may have picked

up the work by trial and error, or from other workers who had no better idea of the right way to do the job than they. By this learning method they may have fixed upon a sufficient number of wrong ways to do the job to prevent them from ever attaining satisfactory performance without corrective help. On the other hand, the initial training received by an employee may have been OK, but because of failure to receive retraining when changes occurred in method or procedure, his knowledge may have actually become a handicap. Think it over.

8. Make Every Trump Count

In making this evaluation of all your workers, it is probable that you will find employees among your good and best who can achieve even higher levels of efficiency on their present jobs, if they are provided with additional training. Our ultimate goal "total employee utilization" will not be attained until each employee is working at his best capacity. Don't miss a trick—don't let any potential ability go begging. Play it smart.

9. Your Stars Need Stand-Ins

a. With us or without us, the show must go on. That isn't theatrics; it is more than tradition; it is cold logic. The continuity of our operations is much too vital to too many people for us to allow it to hinge upon the knowledge and skill possessed by any single individual. We must be prepared to replace any man on any job without serious damage to our productive efficiency. The more important the job, the more important becomes the necessity of covering the incumbent with a well-trained understudy.

b. Since our work is so highly specialized, it is always difficult and sometimes impossible to fill our better positions through outside recruitment. Apart from that fact, it is rarely in the best interests to do so. First, because the most valuable experience for advanced work comes from growth within our own organization and, second, because Federal Service is, and must remain, a career service. It must provide opportunities for advancement to attract desirable employees, and to keep capable and ambitious people on the rolls.

c. Our employees and our organization stand to gain from this policy if you make it work. Train an understudy, a potential replacement, for each of the better positions in your unit including your own. Remember, you open the way for your own promotion when someone is prepared to perform your duties.

10. Try a Shot in the Arm

a. We are trying hard to build an organization in which every employee not only knows how, but also wants to work. We must have an enthusiastic producing team. Enthusiasm is energizing. It makes the difference in the quality of effort expended by those of us who work simply because we must, and those who work also for satisfaction. It raises work above drudgery.

b. While enthusiasm is natural to some employees, in many others it must be consciously inspired. It can be inspired by providing them with an appreciation of the significance and usefulness of the work we do. The accomplishments of the Naval Establishment should be made a source of deep pride and satisfaction to everyone in our employ. Not one of our jobs is unimportant. They are vital parts of a combined effort which produces the largest, and we believe the best service in the world today.

11. Not Sh-h-h-Shout!

a. Men are best motivated by understanding. Understanding clears the air. Understanding permits a worker to share in a knowledge of the reasoning underlying the orders and directives he receives. It provides him with a sense of partnership in the accomplishment of our mission.

b. Some persons in authority have a tendency to pretend an air of pointless secrecy or mystery concerning the most routine matters which come under their jurisdiction. Their employees feel shut off from what is going on about them; they become suspicious of motives; they become victims of rumor. This is not an atmosphere which allows the growth of an intelligent and willing work force. While the need for sound discretion must be recognized, since some matters are confidential and others should not be disclosed prematurely, our intent should be to provide all employees with all information in

which they have a legitimate interest. Don't sit on it—say it.

c. Say it the best way; dignify it. Much of the information we give will be based upon an interpretation of official policy. That means we have a selling job to do. Say it with music. As management representatives it is essential that we present the viewpoint of management logically, convincingly and above all, accurately, so that it will be fully understood by our people.

12. The Team Is the Thing

a. No one person or division of this huge team of ours plans all the plays, calls all the signals, or carries the ball alone. All the goals we attain are the results of cooperative effort.

b. A spirit of mutual assistance must be cultivated in every employee if the activity is to function as a single, efficient outfit. Everyone must pull his share of the load and the whole team must pull in the same direction. One of the principal causes of conflict and lack of cooperation on the part of workers is a failure to appreciate the responsibilities, problems, and functions of other members of the organization. Training can build this appreciation.

13. It All Boils Down to This

a. Training must find a place in your daily routine. Those of us who have neglected our training responsibilities in the past, and those of us who have recently been placed in an altered work situation will find that numerous training problems presently exist, all of which cannot be met at once.

b. Training is no hit-or-miss proposition. We must set an order of priority based upon the urgencies of the specific needs. We should make full use of all available and necessary assistance. Experienced and otherwise qualified employees can assist us as on-the-job instructors if properly guided; training specialists are available to aid in the selection and organization of instructional material, and to help plan and conduct centralized training classes where needs are common to groups of employees and the nature of the matter to be taught dictates that method as most practical and economical.

c. Our efforts should be directed first toward removing any backlog of long-standing training problems and then satisfying our new problems on a current basis.

d. Keeping current in our training job requires alertness and foresight. Certainly, unsatisfied training needs are ultimately reflected in lowered production rates, in increased error frequency, and in such other statistics as may be used to measure the efficiency of our organization. And it is good business practice to analyze them for the unsatisfied training needs they may disclose. But most training demands become apparent long before they are reflected in statistical data. By that time they have already exacted a cost in lost productive efficiency which can never be recouped. We cannot afford to postpone the diagnosis or the remedy until after a post mortem has been performed.

Let us have our training program ready to roll before the need becomes critical. Get going. Training is your business.

14. How Do You Measure Up?

a. Do you believe that a new man needs no planned training to perform some of the jobs you supervise?

b. Do you ever let a substandard employee drift without taking positive action to improve his work performance?

c. Do you feel that it is best to let well enough alone so long as a worker is meeting your standard of efficiency?

d. Do you ever announce a new policy which affects your workers without explaining the reason for its adoption?

e. Do you ever indicate to your workers that you are personally opposed to an official policy?

f. Do your employees resent helping out with the work in another unit when needed?

g. Does production slacken off when you leave the work area?

h. Must all non-routine work in your unit be reserved for a few better employees?

i. Must you ever refuse an employee leave because no one else can perform his job?

j. Do you believe that you have completed your training job insofar as your present employees are concerned?

The answers to these questions should pretty well reveal the kind of training job you are

doing. If you can answer "No" to all of them you are doing fine. "Yes" answers are warning flags that you are not squaring up to your responsibility.

0203. THE SCIENCE OF FIRE PROTECTION (FIRE FIGHTING AND FIRE PREVENTION)

1. The Modern Firefighter

a. The fallacy persists, even today (as evidenced by opinions expressed now and then) that the fireman's job consists merely of running out a length of hose, opening a hydrant, and pouring water on a fire, and that anyone with enough brawn can be a fireman.

b. Although the above opinion is not as prevalent as it was formerly, still many Navy people believe that a man strong enough to throw up heavy ladders and drag loaded hose lines is good material for the fire department. It is easy to understand why such a misconception continues. During World War II, Naval military personnel were trained in 2- and 5-day classes at Shipboard Fire Fighting and Crash-Fire-Rescue Schools. However, these schools were intended only to instruct military personnel in a few basic fundamentals of fire fighting tactics, in the use of a few special fire fighting appliances, in the hazards of fire, and in the limitations of the tools they employed. This training prepared them for emergency firefighting aboard ship and for airplane crash fire rescue. The program was excellent and gained world-wide recognition. However, it was not intended to qualify trainees in all phases of the science of fire protection, and no such claims were ever made for the program.

c. Firemanship is a technical occupation, requiring highly specialized study in the fields of fire prevention, detection and control. This profession is not learned at a school in 2, 5 or 30 days, nor is it necessarily acquired in an organized fire department in 1, 5 or 20 years. The modern firefighter must not only be physically fit, but he must be able to understand the vast scope of technological development in the science of fire engineering, a science which is continually becoming more complex. With every new development in science and industry the modern firefighter must be ready to meet the fire problems by developing new tactics, procedures and methods of fire prevention and fire fighting.

d. A tremendous responsibility is put upon military personnel with little or no previous fire fighting training, when they are assigned to full time fire fighting duty as is the case in certain areas, particularly extra-continental Naval shore activities. This task is appreciated more when it is recognized that in modern municipal fire departments, recruit firemen are selected from a Civil Service Register which is made up from a list of applicants who have passed in competition the following basic requirements:

(1) Age: 21 to 31 years.
(2) Education: High school graduate.
(3) Physical Examination: Equal to that of the Marine Corps.
(4) Physical Aptitude Test: Comparable to that given in selecting Commando personnel for training.
(5) Written Examination: General knowledge, similar to college entry examination.

e. The recruit (boot) municipal fireman selected from the approved civil service register is put on probation from 6 to 12 months to determine his physical and mental aptitude for firefighter duty. For the first 4 years, the fireman attends a drill school, and classes in a fire college, in addition to his practical experience as a fire fighter in various types of fire companies. At the end of this period he becomes a first grade fireman (private). His advancement beyond the grade of fireman is through competitive Civil Service examinations, and depends upon his iniative, leadership, further study and training.

f. Since municipalities have benefited by their long years of experience in requiring high standards for entry and advancement in the fire service, it is considered important that the Navy give like attention to the selection, training and retention of firefighter personnel.

0204. TRAINING AIDS

1. An excellent series of 16-mm. sound motion pictures on fire fighting training are available to Naval activity fire chiefs. They may be obtained on loan from naval district and fleet film libraries.

2. The training pictures in this series available now are as follows:

Title	*Navy Number*
a. "Ventilation"	MC–7814B
b. "Structure Fires"	MC–7814C
c. "Hose Lays Triple Combination Company"	MC–7814D
d. "Ladder Handling"	MC–7814E
e. "Hose Handling"	MC–7814F
f. "Object Lesson in Fire Prevention"	MN–6896
g. "Fire and Your Hospital"	MC–7975
h. "Stop Fires and Save Jobs"	MC–7324
i. "The Naval Establishment — The Navy Dept."	MN–6992A

0205. FIRE DEPARTMENT LIBRARY

1. A ready reference technical library containing nationally recognized fire publications is important to the operation of an efficient fire department. Such material however should be available to and used by all members of the fire security organization.

2. Fire protection bulletins, instructions, books, and publications recommended for a Navy fire department library follow:

a. Naval District fire officers bulletins.

b. Current Navy publications, e. g. Bureau of Ships Manual, chapter 93, Fire Fighting Ships; Bureau of Yards and Docks Technical Manual, TP–PU4; Bureau of Aeronautics Fire Crash-Rescue Manual; United States Navy Safety Precautions, OPNAV 34P1; United States Navy Airplane Crash Fire Fighting, PB 97925, Office of Technical Service, U. S. Department of Commerce, Washington 25, D. C., 1949, $2.75; United States Navy Structural Fire Fighting Manual, 1953, OPNAV Instruction 5560.7, available at U. S. Government Printing Office, Washington, D. C. (Price undetermined at time of writing.)

c. Forest Service—United States Department of Agriculture Manual entitled "Water v. Fire" available for 30¢ from Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

d. Regional Forester, region 5, United States Forest Service, 630 Sansome Street, San Francisco 11, Calif. Manual entitled "Forest Fire Fighting Fundamentals." The cost of this manual is not known but believed to be about 50¢.

e. Handbook of Fire Protection (published by National Fire Protection Association, 60 Batterymarch Street, Boston, 10, Mass.). Price $10.50.

f. Oklahoma A. & M. series of booklets on fire service training (A. & M. College Book Store, Stillwater, Okla.).

g. Fire Engineering (Fire Protection magazine) Case-Shepperd-Mann Publication, 24 West 40th Street, New York 18, N. Y. $3.50 a year.

h. Firemen—monthly magazine published by National Fire Protection Association, 60 Batterymarch Street, Boston 10, Mass. $1.25 a year to NFPA members.

i. Operating Fire Department Pumpers, National Fire Protection Association publication. Price, $2.50.

j. Handbook of Disaster Control 1952, $2.50, University of Southern California textbook, by Cdr. Charles W. Bahme, USNR, 8631 Olin Street, Los Angeles 34, Calif., author Firemen's Law Book.

k. National Board of Fire Underwriters, Special Interest Fire Service Bulletins (free to fire officials), 85 John Street, New York, N. Y.

l. National Board of Fire Underwriters—Pamphlets on fire protection (free to fire officials), offices at 85 John Street, New York City; 222 West Adams Street, Chicago, Ill.; and Merchants and Exchange Building, San Francisco, Calif.

m. "Salvage"—An illustrated booklet available without cost from the National Board of Fire Underwriters, 85 John Street, New York, N. Y.

n. Fire Department Pumps, Pumping Equipment and Pumping. International Association of Fire Chiefs, 22 East 38th Street, New York 16, N. Y. Price $1.50.

o. Factory Mutual Bulletins of Loss Prevention, and also the "Record," Published by the Factory Mutual, Engineering Division, 184 High Street, Boston 10, Mass.

p. NFPA Inspection Manual 1951, 60 Batterymarch Street, Boston 10, Mass.

q. Municipal Fire Administration, 1950, Published by the International City Managers Association, 1313 East 60th Street, Chicago, Ill. Price, $10.00.

r. Public Service Guide to Fire Protection, Published by The Reader's Digest Association, Inc., Pleasantville, N. Y. Price $0.25 each and special prices on quantity orders.

s. "The Firemen's Responsibility in Arson Detection," a booklet published by the National Fire Protection Association. Price $0.50.

0206. MEMBERSHIP IN FIRE PROTECTION ASSOCIATIONS

1. Naval shore activities with organized fire departments are encouraged to become affiliated with the National Fire Protection Association by maintaining an annual membership. Newsletters, quarterly publications, special interest bulletins (new developments, fire protection problems, large and/or unusual fires, etc.) are provided to NFPA members. Cost $12.50 annually.

2. Fire Chiefs of Naval activities are eligible for active membership in the International Association of Fire Chiefs (Hdqtrs. Hotel Martinique, Broadway at 32d Street, New York 1, N. Y.) and are invited to become affiliated with this professional association at their own expense. IAFC publications and technical bulletins are free to members. Annual dues $6.00 to $8.00 depending on regional affiliation.

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Chapter 3

FIRE FIGHTING EQUIPMENT AND ITS USE

Appliances—Tools—Rescue Equipment

0301. INTRODUCTION

1. Chapters 3, 4, 5, 6 and 7 provide a survey of structural fire fighting equipment generally used on naval shore activities. This includes an explanation of the use and care of the equipment, tools and appliances.

2. However, this does not mean that all the items listed in these chapters are needed on every naval shore activity. Good judgment should be exercised in requisitioning fire equipment.

0302. EXTINGUISHERS

1. Hand Pump Type (Navy Type, Water)

a. General Description.

(1) Portable hand pump tank extinguishers of the Navy type (fig. 1), are carried on practically all apparatus for use on incipient fires requiring a cooling agent.

(2) These extinguishers have a capacity of 2½ and 5 gallons of water and are equipped with a double action pump capable of discharging a stream a distance of 30 to 40 feet. When carried on fire apparatus this water extinguisher should be equipped with a 10-foot length of hose and a shoulder strap (fig. 1).

(3) This type extinguisher can be operated by 1 man, though, under certain conditions such as on ladders, pitched roofs, etc., it is advisable to use 2 men.

(4) More effective use of the limited amount of water contained in these extinguishers may be obtained by holding a finger over the nozzle and spraying the water over the burning material.

b. Basic Operations.

(1) Release nozzle and coiled hose from keeper.

(2) Direct nozzle with one hand; operate pump with other hand.

(3) When using 2 men, 1 man operates pump; other man directs nozzle.

c. Maintenance.

(1) Inspect extinguisher regularly and after use to detect deteriorated, worn or damaged parts.

(2) Test pump frequently, directing stream into tank.

(3) Lubricate piston rod as needed, using a few drops of lubricating oil.

(4) Keep tank filled with clean water to a level that will just avoid spilling while being carried on apparatus.

Figure 1.

(5) If possible, refill tank before leaving scene of fire.

(6) When placing coiled hose and nozzle in keeper on tank, place nozzle at a higher level than the surface of the water to prevent siphoning.

(7) Protect extinguishers against freezing when necessary.

d. Preference.

(1) For Class "A" fire extinguishment on naval shore activities, the hand pump type extinguisher (fig. 1) is preferred to the soda and acid (fig. 2) and/or the pressure reaction (fig. 3) type extinguishers. Simplicity of operation and low maintenance cost are the desirable features of the hand pump tank type extinguisher. When procuring new or replacement cooling agent type extinguishers the hand pump tank type extinguisher should be given first priority.

2. Chemical Reaction Type (Soda and Acid)

a. General Description.

(1) Soda and acid extinguishers of this type (fig. 2), usually have a capacity of 2½ gallons and are suitable for use on incipient fires requiring a cooling agent.

b. Basic Operation.

(1) Operation of these extinguishers will vary with the design, but in general will fall under one of the following methods, however, full instructions will be found attached to each extinguisher.

(a) Screw Stopple Type (fig. 2). Release stopple screw and invert.

(b) Break Bottle Type (b–fig. 2). Turn wheel screw in cap.

(c) Loose stopple Type—Invert.

c. Maintenance.

(1) Recharge after use and at intervals of 12 months if not used during that period.

(2) Inspect extinguisher each time recharged to detect deteriorated, worn or damaged parts, and specific gravity of acid (Hydrometer Test should read 1.84 or 66° BE).

d. Recharging.

(1) Follow explicitly, the instructions of manufacturer as attached to extinguisher tank.

3. Pressure Reaction Type (Carbon Dioxide Cartridge and Water)

a. General Description.

(1) Pressure reaction extinguishers of this type (fig. 3), usually have a capacity of 2½ gallons and are suitable for use on incipient fires requiring a cooling agent. These extinguishers are capable of discharging a stream a distance of 30 to 40 feet.

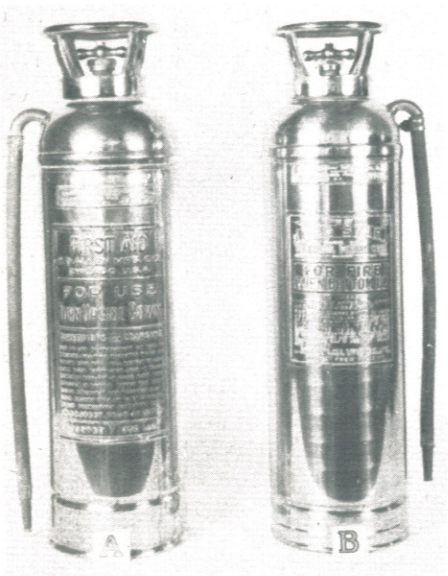

Figure 2.

Figure 3.

b. Basic Operations.

(1) Invert extinguisher.

(2) Bump down to operate plunger cutter.

(3) Direct nozzle with one hand, while carrying extinguisher with other hand.

c. Maintenance.

(1) Inspect extinguisher regularly and after use to detect deteriorated, worn or damaged parts.

(2) Weigh CO_2 cartridge every 6 months if not used.

(3) Protect extinguisher against freezing when necessary.

d. Recharging.

(1) Following explicitly, the instructions of manufacturer as attached to extinguisher tank.

4. Carbon Dioxide Type (CO_2)

a. General Description.

(1) Carbon dioxide acts in fire extinguishing, primarily by reason of its action in displacing or diluting the air to a point where the oxygen content is below that necessary to maintain combustion. There is also a limited cooling effect when applied in the form of snow.

(2) Carbon dioxide is effective on fires in volatile liquid and due to its nonconductive characteristics, is suitable for electrical fires.

(3) Carbon dioxide is harmless to use except that it may reduce the oxygen contents of the air to a point below that necessary for breathing; however, extreme care must be exercised while using this agent due to the possibility of a reflash.

(4) At ordinary temperature and atmospheric pressure, carbon dioxide is a gas one and one-half times as heavy as air. It is generally stored in steel cylinders under sufficient pressure to liquefy approximately three-fourths of the contents; the pressure at normal room temperature is between 800 and 900 pounds. Upon release the liquid changes to a gas with a ratio of expansion of from 1 to 450 times its stored volume.

b. Basic Operations.

(1) With extinguisher (fig. 4) in upright position, remove horn from keeper.

(2) Remove locking pin from squeeze-grip control valve.

(3) Grasp cone nozzle by insulated grip and direct at base of fire.

(4) With free hand operate squeeze-grip control valve.

c. Maintenance.

(1) Inspect regularly to detect deteriorated, worn or damaged parts.

(2) Weigh after use and in hazardous locations, monthly; elsewhere, semiannually.

(3) Recharge when contents are reduced 10 percent or more.

(4) Avoid exposure to the rays of hot sun for extended periods of time.

d. Recharging.

(1) Follow Navy directives.

(2) Where located in rooms, or areas, with abnormally high temperatures, it is advisable to fill only to about 90% of rated capacity.

Figure 4.

5. Carbon Tetrachloride Type (CCL4, Hand Pump Type)

a. General Description.

(1) Carbon tetrachloride extinguishers (fig. 5) are not standard equipment on the fire department though some fire apparatus and automotive vehicles are so equipped. This type extinguisher is not recommended for Navy use, and wherever practicable, suitable substitutes of lesser toxicity should be used.

(2) A heavy, specially treated liquid having a carbon tetrachloride base is used in these extinguishers, which, when played upon a fire rapidly vaporizes forming a smothering gas heavier than air.

(3) Due to the nonconductive characteristics of carbon tetrachloride, these extinguishers are suitable for use on electrical fires.

(4) The extinguisher should be operated from the windward side and stream directed at the base of fire where the liquid will be vaporized and carried over the burning material.

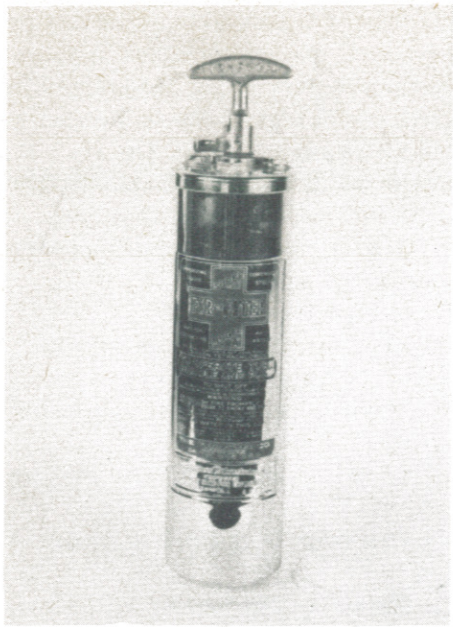

Figure 5.

(5) Carbon Tetrachloride vapors are toxic (see BuMed Instruction 6200.5, 17 July 1953) and in contact with high temperatures will produce even more poisonous gases; therefore CCL4 extinguishers should not be used in confined spaces or where conditions are such that the user may breath the fumes.

(6) A double-acting pump, operated by hand, provides the necessary pressure for expelling the liquid from the extinguisher.

b. Basic Operations.

(1) Hold body of extinguisher in palm of one hand.

(2) With other hand, turn pump handle until it unlocks.

(3) Operate pump.

c. Maintenance.

(1) Inspect regularly to detect corroded, deteriorated, worn or damaged parts.

(2) Check frequently for evaporation.

(3) Keep extinguisher filled to proper level to prevent accumulation of moisture.

(4) Test monthly by discharging a portion of the liquid.

(5) Recharging and testing of carbon tetrachloride extinguishers shall be done in the open and using suitable personal protective equipment.

d. Refilling.

(1) Refill only with carbon tetrachloride especially prepared for use in these extinguishers.

6. Hand Pump Tank (Knapsack Type, Water)

a. General Description.

(1) Hand pump tanks of the knapsack type (fig. 6) are carried on brush and grass fire apparatus for use on brush and grass fires, however, they are effective for use on incipient fires requiring a cooling agent.

(2) This type extinguisher is worn on the back and is operated by one man.

b. Basic Operation.

(1) Release pump from keeper and lay to one side.

(2) Turn back to pump tank; insert arms through shoulder straps.

(3) Reach back and grasp barrel pump; bring under arm.

(4) Hold barrel of pump with one hand; operate plunger with other hand.

c. Maintenance.

(1) Inspect extinguisher regularly and after use to detect deteriorated, worn or damaged parts.

(2) Clean strainer and tank when necessary.

(3) Keep breather hole in cap open.

(4) Keep tank filled with clean water.

(5) If possible, refill extinguisher before leaving scene of fire.

(6) Protect extinguishers against freezing when necessary.

Figure 6.

7. Pressure Reaction Type (Dry Powder)

a. General Description.

(1) Extinguishers of the hand type (fig. 7) are made in many sizes, having a capacity of 2½ to 30 pounds of dry powder. These extinguishers are effective on fires in small quantities of flammable liquids, greases, etc., in open vessels or on floors, etc., i. e., on Class "B" fires, where the cloud of chemical may be employed to separate the flame from the burning surface.

They are effective on incipient fires in electrical equipment, i. e., on Class "C" fires where a nonconducting extinguishing agent is of importance. They are suitable also for use on automobiles, motor boats, etc.

Figure 7.

They are not effective on deep-seated fires of ordinary combustible materials such as wood, paper, textiles, rubbish, etc. (Class "A" fires), which require the quenching and cooling effect of water for complete extinguishment, but they may be of value for surface fires in small quantities of such material where the smothering effect of the extinguishing agent may be utilized.

Surface fires in textile and paper operations may be effectively controlled by dry chemical extinguishers. In this application, they should be supplemented by water spray to extinguish any deeper seated fires which may be present.

(2) One of the advantages of dry powder is the reach of the extinguisher discharge; an added characteristic is that the transformation of ingredients changing from a powder to carbon dioxide gas is produced directly when the heat of the fire is reached producing the blanketing effect directly over the fire area.

(3) The dry powder is expelled by means of a pressurized gas.

b. Basic Operations.

(1) With extinguisher in upright position; remove nozzle from keeper.

(2) Remove locking pin from pressure control valve.

(3) Operate valve to rupture pressure cylinder.

(4) Open nozzle and direct stream at base of flame.

(5) Before attempting to refill a partially discharged extinguisher, comply with instructions on body of extinguisher to release remaining pressure.

c. Maintenance.

(1) Inspect regularly to detect deteriorated, worn or damaged parts.

(2) Remove pressure cylinder and weigh, inspect compound and determine if free flowing.

d. Recharge.

(1) Follow explicitly, the instructions of manufacturer as attached to fire extinguishers.

8. Foam (Hand Type)

a. General Description.

(1) Hand foam extinguishers are made in three principal sizes, one having liquid capacity of 1¼ to 1½ gallons, and the others 2½ and five gallons, and are effective on fires in small quantities of flammable liquids, greases, etc., in vats or other open vessels or on floors, etc., i. e. on Class "B" fires, where the foam may be retained as a blanket on the burning material. Unless specifically noted on name plate, these extinguishers are not recommended for use on fires in alcohol type (Polar) solvents.

(2) While these extinguishers are primarily intended for use on Class "B" fires they are effective on incipient fires in ordinary combustible materials (such as wood, paper, textiles, rubbish, etc.), where the quenching and cooling effect of quantities of water or solutions containing large percentages of water is of first importance.

(3) Their use in connection with fires in electrical equipment such as panelboards, switchboards, motors, and the like (Class "C" fires) is not recommended. If used on electrical equipment, said equipment should be made electrically dead before applying foam solution.

(4) The force, range, and duration of the stream are not dependent upon the operator. The 2½- and 5-gallon extinguishers discharge an effective stream of foam for approximately 1 minute, and can be directed effectively from a distance of 30 to 40 feet horizontally.

b. Basic Operations.

Follow directions attached to extinguishers:

1—Grasp hose and nozzle properly.

2—Invert and direct stream.

3—Stream should be directed against inside of opposite wall of tank above burning liquid so as not to splash fire. Walk around fire if possible. If fire is on floor, stand back and allow foam to fall on fire without much force, thereby preventing spread of flames.

c. Maintenance.

Extinguishers shall be recharged annually and immediately after use. Extinguishers shall be examined monthly to make sure that they have not been tampered with or removed from their designated places; to detect any injuries; also to see that they are not empty, and to see that the orifice of the nozzle is not clogged.

NOTE.—If an extinguisher shows evidence of corrosion or mechanical injury, it may be unsafe for further use and shall be given a Hydrostatic Pressure test.

d. Recharge.

Follow the instructions of the manufacturer as attached to extinguisher.

0304. PRINCIPLES OF MINOR EXTINGUISHMENT

Demonstrating the Use of Fire Extinguishers

The fire chief of a naval station is frequently engaged in demonstrating the use of first aid fire appliances, not only to assure himself that his own firemen are thoroughly familiar with their use and operation, but also to educate the station's personnel as a whole. Such demonstrations should be planned to meet the requirements of the audience. For example, when talking to a group of children at a Naval base grade school, the emphasis should be primarily on the importance of notifying the fire department and orderly evacuation of the buildings, rather than fighting the fire. While it is desirable that students see how extinguishers are operated on test fires, yet the instruction should be directed principally to the teachers and custodians who will normally be expected to use them pending the arrival of the fire department. On the other hand, when the subject is being taught to regular fire fighters much greater detail and related technical data should be given than would be desirable for students or even general station personnel (fig. 7b).

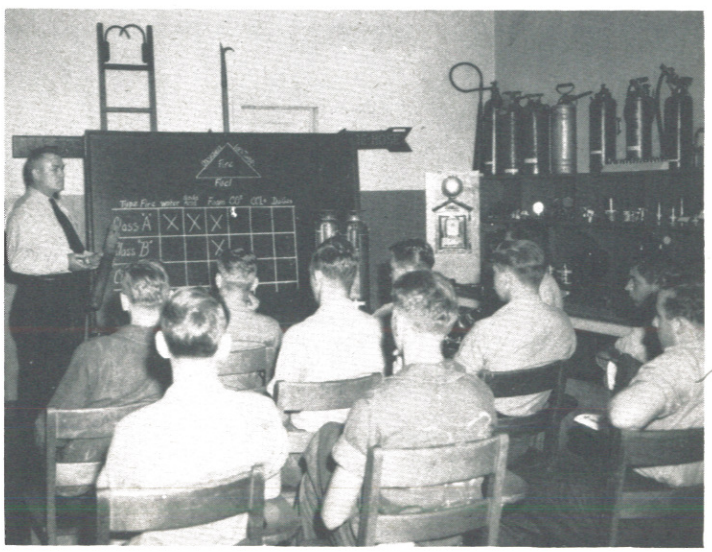

Figure 7b.

PREPARATION

In preparation for such a demonstration it is well to select an open area where there will be plenty of room for the spectators to watch and where the smoke from the test fires will not disturb others. For the class B fires, two pans should be provided, a small one no larger than a sauce pan for filling completely to the top, and a large nonsoldered metal container about 12 to 18 inches deep and 2 or 3 feet in diameter (the bottom third of an old oil drum is often used).

Crankcase drainings or old oil should be placed in the large container, leaving about half its depth for outage.

A 5-gallon safety can of gasoline should be provided for filling the small container and for priming the oil mixture in the larger one just before the fires are ready to be ignited. There should also be provided, several feet away from the oil pans, a pile of wood, papers, rags, shavings, etc., 2 or 3 feet in diameter and about the same height, to serve as a class A fire (neither the oil nor wood fires should be ignited, however, until after the introductory talk which precedes the demonstration).

In an orderly row several feet to the windward of the pans should be placed two fully charged fire extinguishers of each type in use on the station. If cutaway extinguishers are available to show the interior construction of each extinguisher, these should be lined up in their respective positions. If not available, then empty ones which can be disassembled will serve the purpose.

It is also desirable to spot one of the station's fire trucks on one flank of the scene, not only as a standby precaution but also to demonstrate the effect of a small fog applicator (off the booster line) on a class B fire, later in the demonstration. Furthermore, the person giving the demonstration should have prepared a few notes on small cards, outlining the subject matter to be covered and the order of presentation. After the talk has been given several times perhaps the use of such notes will not be necessary, but their preparation is worth while from the standpoint of organizing the material.

When all is in readiness the group should be assembled in a semicircle on the windward side of the set-up (see fig. 7c) ; the opening remarks to a group of general station personnel should emphasize the provisions of the fire bill—particularly its first requirement in case of fire—that of calling the fire department immediately before attempting to use available fire equipment.

The following outline is suggested as the basis for a talk and demonstration to a naval station's fire fighting personnel.

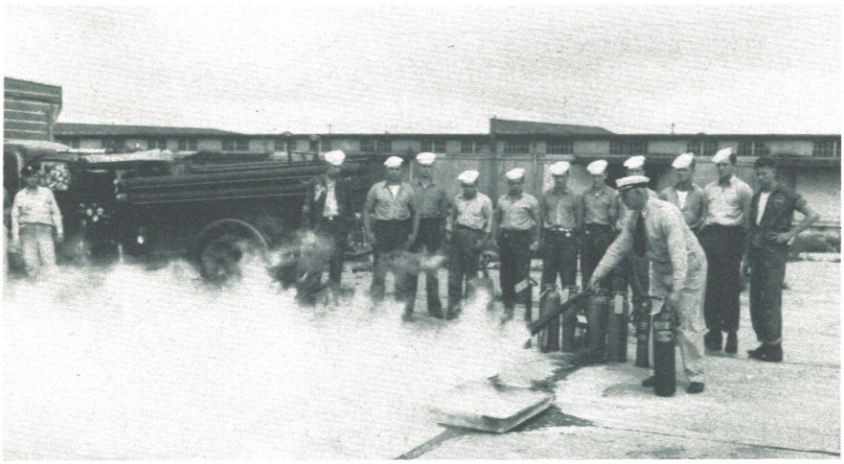

Figure 7c.

FIRST-AID FIRE APPLIANCES

(Suggested Outline for Demonstration)

I. GENERAL PRELIMINARY INFORMATION

A. Meaning of "First-Aid Fire Appliances"

1. They are essentially first-aid devices provided close at hand for immediate use when needed.

2. They are designed to cope with fires in their incipiency, pending the arrival of the fire department.

3. They are considered necessary even though the property is equipped with automatic sprinklers or standpipe hose.

B. Reason for Different Types of Extinguishers

1. If any one type had ever been discovered that would handle all kinds of fires it would be in universal use; since there has not, extinguishers are classified according to their suitability for use on given classes of fires.

2. Define the classes of fires A, B, and C.

Class "A" Fires.—Fires in ordinary combustible materials where the quenching and cooling effects of quantities of water, or solutions containing large percentages of water, are of first importance.

Class "B" Fires.—Fires in flammable liquids, greases, etc., where a blanketing effect is essential.

Class "C" Fires.—Fires in electrical equipment, where the use of a "nonconducting" extinguishing agent is of first importance.

C. Explain "Unit of First-Aid Fire Protection"

1. Underwriter's Laboratory Inc. has established a unit for convenience in measuring the fire protection afforded by portable fire extinguishers. The unit is composed of from one to five hand-portable fire extinguishing appliances, depending upon the extinguishing value of the kind and size of appliances comprising the unit.

2. Meaning of "A–1" or "B–2, C–2".

"A–1" signifies that the appliances so classified are suitable for use on "A" fires and that one such appliance is required to make one unit of first aid fire protection. The classification "B–2, C–2" signifies that the appliance so classified is suitable for use on class "B" and class "C" fires, and that two such appliances are required to make one unit of first aid fire protection, etc.

3. Point out the label of the approved testing laboratory on each type of extinguisher, and explain its significance and importance. (See the Underwriters' Laboratories Inc. "List of Inspected Fire Protection Equipment and Materials," to determine whether that organization has approved a given make of extinguisher. Factory Mutual Laboratories also provide a testing and labeling service.) Give examples of so-called "extinguishers" which are not approved.

D. Distribution of Units

1. The required number of units may be obtained by providing devices of any of the types described in the NBFU Pamphlet No. 10 (National Board of Fire Underwriters, 85 John St., New York City), or a combination of two or more types, selected in accordance with character of the fires anticipated and their suitability for the individual property protected.

2. The number of units of first aid fire protection to be installed depends upon the relative severity of the incipient fire anticipated; i. e.; the relative rapidity with which a fire may spread and the relative intensity of the heat that may be developed.

Where there are special hazards in addition to the ordinary hazards of the occupancy, additional units of suitable type should be installed for the protection of such hazards.

3. As a guide in determining the number of units which should be installed under various conditions the following recommendations are given, based upon the relative hazard of the occupancies:

(a) Class I.—Light Hazard Occupancies, where because of relatively small amount of combustibles, incipient fires of minimum severity may be anticipated. Units should be so located that a person will not have to travel more than 100 feet from any point to reach the nearest unit, but at least one should be provided for each 5,000 square feet of floor area. This

class may include occupancies such as offices, schools (exclusive of trade schools and shops), public buildings, etc.

(b) Class II.—Ordinary Combustible Occupancies, where incipient fires of average severity may be anticipated. Units should be so located that a person will not have to travel more than 50 feet from any point to reach the nearest unit, but at least one should be provided for each 2,500 square feet of floor area. This class may include stores, warehouses, miscellaneous manufacturing occupancies of average hazard, etc.

(c) Class III.—Extra Hazardous Occupancies, where because of character or quantity of combustibles, extra severe incipient fires may be anticipated. Units should be so located that a person will not have to travel more than 50 feet from any point to reach the nearest unit, plus additional units as required by the character of the occupancy, but at least one unit should be provided for each 2,500 square feet of floor area. This class may include occupancies such as woodworking, paint spraying and dipping, etc.

4. Wheeled devices.

(a) Wheeled extinguishers should be of sufficient size and number to be effective upon the fire anticipated. The number and location should be such that it will not be necessary to travel a greater distance than 200 feet to a wheeled extinguisher or a sufficient number to cope with the fire considered. At points where extra severe fires are probable; such points would include hangars, refueling locations, etc.; wheeled extinguishers should be so located that the travel distance to the nearest unit will not be greater than 75 feet. Additional extinguishers, where required, should be provided in accordance with the relative severity of the probable fire. Devices should be so located that the probable fire will not interfere with reaching them.

II. FUNDAMENTAL FACTS ABOUT COMMON FIRE EXTINGUISHERS

A. Order of Presentation (for lecture purposes only)

1. Cooling type.
   (a) Water pump can.
   (b) Plain water (CO_2 cartridge).
   (c) Soda-acid.
   (d) Any others which may be in use on station.
2. Cooling and smothering type.
   (a) Foam.
   (b) Loaded stream.
3. Smothering type.
   (a) Carbon dioxide.
   (b) Vaporizing liquid.
   (c) Dry powder.

B. Facts to Cover

1. Most common sizes of the type in question. (Show examples.)

2. Underwriters (classification of each size and type shown).

3. Relative effect on each class of fire.

4. Contents and construction (use cut-away, diagram, or disassemble empty one).

5. Instructions for operation (illustrating with empty ones, how to remove from bracket, carry, invert, pump, etc., but not using on test fire at this point).

6. Limitations.
   (a) Period of time it will operate.
   (b) Extent to which its operation depends upon the strength and skill of the operator.
   (c) Distance away from fire at which it can be effectively operated.
   (d) Deleterious effect (if any) involved to the operator, either in confined spaces, or from having some of contents spilled on his clothes or skin.
   (e) Relative amount of damage that may be done to materials involved in the fire; e. g., to food, to written records, to fine textiles, electrical windings, etc.
   (f) Electrical conductivity.
   (g) Flash-back possibility.
   (h) Climatic limitations; e. g., effect of continued high temperatures (on compressed gases), freezing temperatures (on water type), damp and humid conditions (on powder).

7. Maintenance.
   (a) Desired frequency of inspection.
   (b) Matters checked upon inspection.
   (c) Interval for recharging, weighing, partly discharging and refilling, etc.

III. DEMONSTRATION

A. Principles of Combustion (light up the class A fire at this point)

1. Define combustion.

2. Explain the three elements necessary to have fire.

3. Give examples of how removing one of the elements will extinguish a fire; e. g., garden hose on a bonfire removes the heat; blanket around a clothing fire removes the oxygen; firebreak removes the fuel, etc.

B. Use of Extinguishers

1. Carbon Dioxide (15- or 20-pound size).

(a) Pull pin, noting the time when actual discharge is commenced, thereby calling attention to the limited duration of operation which first-aid fire appliances have.

(b) Discharge on the class A fire (which should be burning fairly well by this time), pointing out how it temporarily suppresses the fire, but rekindles quickly owing to the absence of any substantial cooling effect. Although the carbon dioxide snow which is discharged is about 110° F. below zero, the cooling effect is only momentary.)

(c) Light up both the large and small oil fires, and with a second extinguisher, demonstrate how quickly it smothers both fires, even though the small one has no outage.

(d) Discharge some of the contents on the clothing to show its harmlessness to textiles.

(e) Reignite the class B fires and have another man demonstrate how to extinguish, using remainder of second extinguisher.

2. Vaporizing Liquid (carbon tetrachloride base).

(a) Demonstrate its lack of effectiveness on the class A fire (which should be well rekindled by this time).

(b) Call attention to the characteristic odor of the vapors which are toxic under ordinary conditions, and when decomposed by heat or flame, produce poisonous gases.

(c) Demonstrate its effectiveness on the large class B fire, when the stream of liquid is directed against the hot sides of the container at a point above the oil level.

(d) Demonstrate how the flammable liquid in the small filled container is splashed around, spreading the fire, when the stream is pumped directly into the liquid.

(e) Permit another man to try it on the class B fires.

3. Dry powder.

(a) Discharge contents on the class A fire (which, when the materials are being consumed, should be replenished at intervals) to illustrate its relative ineffectiveness on this type of fire.

(b) Demonstrate its effectiveness on both the large and small class B fires.

(c) Have another man follow the example.

4. Water type.

(a) Pump a few squirts from a pump can, or knapsack type on the large oil fire, to demonstrate its ineffectiveness on class B fires.

(b) Noting the time, demonstrate the operation of the soda-acid type extinguisher; direct a small amount in the large class B fire, to show its limitations on this class of fire, and then discharge the balance of the contents at a 30° angle to show its reach and duration of operation.

(c) If the plan water (CO_2 cartridge) type is on hand, repeat the preceding demonstration; in any event, its method of operation should be explained (invert and bump) as this type, as well as the 2½-gallon pump can, not requiring annual recharging and to which antifreeze compounds can be added, are replacing the soda-acid type on some naval shore establishments.

(d) If the loaded stream type is available, demonstrate its use on the large class B fire.

(e) If used on the station, show a standard fire pail, and explain why its base is convex-shaped or else has a few small holes punched in the bottom (if merely an ordinary bucket).

(f) Point out that the above extinguishers would be effective on the class A fire, though not demonstrated on it.

5. Foam type.

(a) Point out the difference in the size nozzle tip on this type as compared with the soda-acid type, and also the difference in recharging instructions printed on the shell of the container, as methods of distinguishing the two where they have not been clearly stenciled as to type.

(b) Discharge one foam extinguisher on the wood fire to demonstrate that this type is suitable for class A fires.

(c) Re-ignite the oil fires and discharge another foam extinguisher to show their effectiveness on class B fires.

(d) Point out the seven to eight-fold expansion of the liquid.

IV. QUIZ—REVIEW

A. After the demonstration, the following questions might be asked of the persons witnessing it (in rotation) to determine whether or not the principles taught have been understood:

B. General Questions:

1. What principles of extinguishment are illustrated in the following examples?

(a) Steam?

(b) Fog? (smothering and cooling).

(c) Gas valve?

(d) Fire break?

(e) Dynamite? (removal or severance of fuel from the heat).

(f) Garden hose? deluge sets, circulating nozzles? (cooling).

(g) Blanket? inert gas? sand? closing lid? (smothering).

(h) Subsurface injection of foam? (cooling and smothering.)

(i) Loaded stream? (inhibition of oxidation by a negative catalyst).

2. What are the types of fires? Give examples. (Describe A, B, and C fires.)

3. What is combustion? What are the necessary elements? (chemical process accompanied by evolution of light and heat; fuel, oxygen and heat).

4. What is meant by a "unit of first-aid fire protection"? (See previous discussion.)

5. What pamphlet tells us how many of each type of extinguisher should be placed in various occupancies? (National Board of Fire Underwriters No. 10.)

6. What does the U. L. rating on an extinguisher which reads "B–2, C–2" mean? (It signifies that the appliance is suitable for use on Class "B" and Class "C" fires, and that two such appliances are required to make one unit of first-aid fire protection.)

7. Where should extinguishers generally be located in a room? (Near door).

8. Which is the best extinguisher? (No one type, size or make can be called the "best"; determining factors are: type of fire anticipated; strength, and training of persons intended to use it, conditions of use; e. g., indoors or out-of-doors, climatic limitations, etc.)

9. What causes fire extinguishers to explode? (National Fire Protection Association April 1939 Quarterly states that lack of proper care and maintenance is chief reason; failure to follow the manufacturer's instructions in recharging, excessive or wrong type of chemicals, corrosion, plugged outlets, plugged hose nozzle, rough handling, transposing caps. Note: Extinguisher explosions are very rare.)

10. What are the principal methods of expelling water out of portable extinguishers? (By pump, cartridge of inert gas, chemically generated pressure, air compressed upon filling from hydrant or from air hose, and a slow burning fuse cartridge.)

11. Under what conditions is it inadvisable to use a straight stream of water in connection with fighting a fire? ((a) At close range on high voltage wires or appliances; (b) on flammable liquids of lower specific gravity than water unless they are soluble in water, e. g., alcohol; (c) where molten solids, e. g. salts, are involved; (d) when dusts in large quantities are involved; (e) on materials which react with water to evolve considerable heat; examples of such materials are: concentrated sulphuric acid, solid sodium or potassium hydroxide (caustic soda and caustic potash), zinc chloride, stannic (tin) chloride, calcium oxide (quick lime), and silicon chloride or tetrachloride; (f) on substances which unite with water to evolve oxygen, hydrogen, oxyhydrogen, or other flammable gases. For example, (1) hydrogen is evolved from the union of cold water with lithium, sodium, potassium, sodamide, and some of the rarer chemicals; it is also evolved at high temperatures with calcium, strontium, and barium. Boiling water will unite with magnesium, and finely powdered zinc, aluminum, and manganese to evolve hydrogen. (2) Oxyhydrogen gas is evolved from the union of water with iron, cobalt, bismuth, or carbon when these are glowing. (3) Acetylene is evolved from the union of water with calcium carbide.)

C. Questions on the Soda-Acid Extinguisher

1. What goes into it? (Bicarbonate of soda, water, and sulphuric acid.)

2. How does it operate? (By inversion or turning hand wheel on top.)

3. How long will it operate? (1 min.)

4. What class of fire is it suitable for? (Class A.)

5. What is the effect of the chemical action? (To generate pressure.)

6. Does the chemical, or the gas generated, extinguish the fire? (No.)

7. Can it be safely used on charged electrical appliances? Why not? (Conductivity of soda solution.)

8. Is pure water a conductor of electricity at ordinary voltages? (No.)

9. How often should it be recharged? (Annually.)

10. How often should it be inspected? (At least monthly in hazardous locations, and according to National Board of Fire Underwriters Pamphlet No. 10, elsewhere.)

D. Questions on the Plain Water (CO_2 Cartridge) Type

1. What are the advantages of this type over the soda-acid type? (Does not have to be recharged annually—antifreeze solutions can be added where desirable—less possible damage to fabrics, etc., from plain water than from a soda-acid type—accidental tipping-over will not discharge it.)

2. What are the advantages of this type over the pump tank? (Antifreeze salts can be added without resulting in the corrosion that occurs to most pump tanks when this is done; cannot be so readily misused for spraying kerosene; fuel, oil, etc., as is not uncommon with the pump tank; does not depend upon the strength or skill of the operator for its operation.)

3. What does inspection of the extinguisher include? (CO_2 cartridge should be weighed annually and be replaced if ½ ounce or more light. Discharge and recharge advisable after a period of years.)

E. Question on the Water Pump Tank Extinguisher

1. What is method of operation? (Varies as to type, e. g., knapsack, pump can, etc.)

2. What can be done to prevent corrosion of the inside shell? (Remove pump, clean, dry, and give coat of zinc chromatic paint.)

3. What are the limitations of this type? (Freezing, conductor of electricity if water not pure; depends upon strength and skill of operator for operation.)

4. How many 2½-gallon pump tanks are required to constitute one unit of protection? (Latest classification only requires one of either 2½- or 5-gallon type.)

5. How is the ordinary kind usually modified for carrying on fire apparatus. (10′ hose is substituted for short one.)

F. Questions on Foam Type

1. What do its chambers contain? (Inner, aluminum sulphate; outer, bicarbonate of soda and foam stabilizing agent; both in water solution.)

2. What is its U. L. rating? (A–1, B–1.)

3. Why is it not given a "C" classification? (Conductivity of solution.)

4. If the label of the extinguisher has been painted and made illegible, how can it be distinguished from a soda-acid type? (By the larger size tip, usually, or by taking off cover and checking inner container.)

5. How does type carried on truck differ from usual kind? (Stopple is held in place by screw clamp, to prevent sloshing.)

6. What is the principle of extinguishment? (Depends whether used on class A (cooling) or class B (cooling and smothering) fire.)

7. How much foam is produced? (Depends upon size of extinguisher; 18 to 20 gallons for the 2½-gallon size.)

8. How does chemical foam differ from mechanical? (In method of generation and content.)

9. What kind of foam do the portable extinguishers make? (Depends upon the type; most produce chemical foam, but a mechanical foam type has been manufactured.)

10. Is foam considered suitable for fighting alcohol fires? (Most prevalent type is not effective on fires involving water-miscible flammable liquids; e. g., alcohol, acetate, etc., but a special type of foam extinguisher is suitable for such fires.)

11. Is it effective on fires in wet carbide? (No; as the acetylene gas generated continues to bubble through the foam.)

12. Is it recommended for motion picture booths? (No.)

13. Does this type require protection from freezing? (Yes.)

G. Questions on Vaporizing Liquid Type

1. What does the fluid consist of? (CCl_4 and other components added to depress freezing point, prevent corrosion, etc.)

2. What kind of pump does the small type have? (Double-acting, with pick-up tubes designed to permit operation with partial contents in either an upward or downward direction.)

3. What is the extinguishment principle? (Liquid vaporizes to produce a heavy smothering vapor.)

4. How does one pound of vaporizing liquid compare with one pound of liquid carbon dioxide, upon being converted to a gas, as regards the number of cubic feet of gas produced at room temperature under normal atmospheric conditions? (CO_2 will produce about 8.6 cubic feet per pound, while CCl_4 will yield about 2.5 cubic feet of gas per pound of liquid.)

5. What are the decomposition products of carbon tetrachloride? (Carbon monoxide, chlorine, and under certain conditions, will react to produce small amounts of hydrochloric acid and phosgene.)

6. Is a toxic gas formed when using this type? (Yes; also, CCl_4 vapors are toxic any time.)

7. What effect does it have on equipment and materials? (It is generally less damaging to ordinary materials and equipment than water or foam, but "on account of its solvent properties it will damage some electrical insulations and the liquid and condensed fumes produce corrosion of metals.")

8. How many of the one quart size does it take to make a unit of class B first aid fire protection? Of the two quart size? Of the two or three gallon size? (Two of any of the above sizes.)

9. Is protection from freezing ordinarily required? (No.)

10. How do the following conditions affect the use of this type; wind and draft conditions? (prevents forming of gas blanket); flammable liquid spill on surface? (No outage to contain the gas); full container of burning liquid. (No outage.)

11. What is the average duration of discharge per gallon for both the hand pump and stored pressure type? (About 1 minute per gallon.)

H. Questions on Carbon Dioxide Type

1. What are the common sizes, and the U. L. ratings for each? ((2 to 20 lb.) B, 4 to B1–C1).

2. In the two pound size, what difference does it make in U. L. rating whether it is equipped with a valve wheel or a pistol grip? (Takes four of the valve wheel type to make a unit of class B protection and it has no class C rating; it only takes two of the pistol grip type to make either a unit of class B or class C.)

3. What is the smallest size that has a B–1, C–1 rating? (Fifteen pound.)

4. What percent of the extinguisher contents is in gas form at temperatures above 88° F.? (100 percent, as that is critical temperature for CO_2 under such pressure.)

5. What is the pressure in the cylinder at ordinary room temperatures? (800–900 pounds.)

6. About how many 15-pound extinguishers should be discharged into a small compartment (10 by 10 by 8 feet) to smother a fire of low severity? (About two, although three would be advisable unless a good seal could be effected; expanding to 8.6 cubic feet per pound, 30 pounds would occupy about 258 cubic feet or about 32 percent of the space; between 25 and 60 percent concentrations are required, depending upon the materials burning, to extinguish a fire, which corresponds to a range in oxygen content in the air of the room from 15.75 to 8.4 percent. Actually, the partial contents of only one extinguisher might extinguish an incipient fire, regardless of the size of the room, if approach and direct application were possible.

7. Describe carbon dioxide. (At normal pressures and temperatures it is a colorless, odorless, inert gas, one and one-half times as heavy as air.)

8. Does it produce any harmful effects? (Is nondamaging to most materials, noncorrosive, leaves no residue, is an electrical insulator, and does not deteriorate with age. It is not toxic, but is suffocating in high concentrations due to oxygen deficiency, if breathed for extended periods.)

9. Why is a rubber insulating handle provided on the nozzle? (Because of its rapid expansion to about 425 times its stored volume, static electricity may be produced in the hard rubber, fiber, or metal nozzle upon discharge; also frost-like condensation is often produced on the outside of the nozzle, which, if brought into contact with a highly charged electrical device, might otherwise result in shock to the operator.)

10. What is considered the maximum range of the 15 pound CO_2 extinguisher? (8 feet.)

11. How is it employed on a fire? (Side to side from nearest edge onward.)

12. How long does the 15-pound size discharge? (35 to 45 seconds.)

13. What is the principal precaution to observe in its use? (Guard against backflash—reignition by incandescent materials or heated container.)

14. How is backflash prevented? (By cooling the objects which may cause reignition.)

15. How often is it recharged? (When used or when, after weighing, a loss of more than 10 percent of its stamped rated capacity is indicated.)

16. How often is it weighed? (National Board of Fire Underwriters recommends yearly; navy policy is to weigh those in extra hazardous locations at least monthly, and other places semiannually.)

17. If the extinguisher has been used for only a few seconds, does it need to be sent in for service? (Depends upon the size, and upon the type of valve; 2-pound size can discharge half its contents in 6 seconds, and cutter-type valve will cause extinguisher to gradually lose its charge; pin requires replacing and should be resealed and reweighed in any event.)

18. What is its extinguishing effect on a magnesium fire? (None.) On a nitrate film fire? (Carbon dioxide and carbon tetrachloride extinguishers have been used on incipient film fires, but owing to their small cooling effect, their value is limited.)

19. Will this type of extinguisher operate in freezing climates? (Yes.)

20. What is the effect upon it of continued temperatures of 135° F. or above? (Where such extinguishers are to be located in abnormally high temperature rooms, it is advisable to fill only to about 90 percent of its rated capacity, for otherwise the safety disks are apt to rupture and release the gas; where suddenly subjected to extremely high temperatures, as in a fire, such extinguishers have exploded when the gas could not escape through the ruptured safety disk fast enough.)

I. Questions on Dry Powder Type

1. What are the sizes commonly manufactured? (2½, 4, 10, 15, 20 and 30 pound.)

2. How is the powder expelled from the extinguisher? (By the rupturing of a cartridge of inert gas.)

3. What does the powder consist of? (A compound principally of bicarbonate of soda chemically processed to make it waterproof and free flowing.)

4. What is the compound's action upon a fire? (Smothering through reaction with heat to produce carbon dioxide and by the powders mechanical exclusion of air.)

5. What is the U. L. rating for the 15- and 20-pound sizes? (B–1, C–1.)

6. What is the horizontal range for the above sizes? (20 to 25 feet.)

7. What is the approximate time of discharge? (About 1 second per pound.)

8. Does the tubular or shaker type have a rating by the U. L.? (No.)

9. Is this extinguisher recognized by the Factory Mutual Laboratories as being effective for stopping flash fires in textile lints? (Yes.)

10. Has a special dry powder been developed for use on fires in magnesium and other light metals? (Yes, and at time of publication of this manual it was being submitted by the manufacturer for U. L. approval.)

0304. ELECTRIC LIGHTING EQUIPMENT (PORTABLE)

1. Different types of portable lighting equipment are provided to supply sufficient light for operations where normal light is deficient.

2. Flashlights, electric hand lanterns, portable spotlights, portable gasoline generators. Schramm trailer units are frequently available to fire departments for emergency use at many naval activities (fig. 8).

Figure 8.

3. The portable gasoline generators and the Schramm trailer units are used when general illumination is desired over a large area, while the smaller portable units are used during average extinguishing operations.

0305. FIRE FIGHTING TOOLS

1. Axes.

a. Axes (flat head).

(1) Two types of flat head axes are in use, a light weight axe for use on special jobs in confined spaces and a heavier type for use in cutting heavy brush (fig. 9).

b. Axe (pickaxe).

(1) This axe (fig. 9) is considered one of the most useful tools carried on fire apparatus.

(2) The pick head axe has many advantages over the flat head axes. It will not only

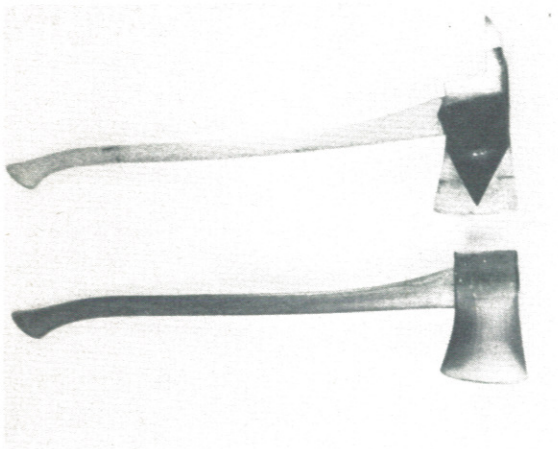

Figure 9.

cut, but the pick becomes a good digging tool for use when overhauling debris. Prying jobs can usually be handled better with the pick than with the blade.

(3) When cutting wood, it should be done at an angle to the grain. Most authorities agree that the proper angle is about 60°.

(4) When cutting floors or roofs, pound with the axe to determine location of joists or rafters, then cut near them. Openings should be square or rectangular.

(5) When cutting boards to provide ventilation, make cuts at both ends of board before removing any of them. This will eliminate working in heat, smoke and gases. The work of removing the cut boards should be conducted from the windward side.

Figure 10.

Figure 10 gives an illustration of cutting flooring at the correct angle.

Figure 11 gives an illustration of cutting subflooring at the correct angle.

Figure 12 gives an illustration of cutting roof sheeting, after the roof covering has been laid back.

Figure 11.

Figure 12.

Figure 13 gives an illustration of breaking glass using the fire axe; stand to one side, strike the pane of glass with the flat side of axe, this will cause most of the glass to follow the axe inward and little of it will fall on the outside of the building. Warn men below when windows are to be broken on upper floors.

Figure 13.

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Figure 14 gives an illustration of using an axe to pry open a window.

(6) When cutting through lath and plaster walls, follow down the center of studding to prevent excessive damage to the plaster.

(7) For prying open locked doors and windows, the blade is inserted between the door or window and the casement, then leverage is applied with handle.

(8) When double hung doors or windows are encountered, force blade between them and apply leverage.

(9) Hinge pins can sometimes be removed by forcing the blade between the hinge and pin and prying the pin out.

Figure 14.

(10) To open window casements for inspection, it is only necessary to insert the blade between the casement and the building and pry off the facing.

(11) The pick can be used to good advantage for prying up iron gratings, planking, pulling lath and plaster, etc. It can also be used for digging.

(12) The pick is excellent for chipping tile, concrete, masonry, etc.

(13) The axe should be kept in good condition at all times. The blade or head is kept clean with emery cloth, then wiped with a rag

dampened in oil. Axe handles are scraped, then treated with boiled linseed oil. Pick head axes are ground in a manner that prevents chipping of the cutting edge to some extent when cutting materials other than wood. The grinding of the axes is not to be attempted by anyone not qualified.

2. Bar

a. Bar (crow).

(1) The crow bar is used to pry up planking, flooring, moving or prying heavy objects, opening heavy bolted doors, etc. (fig. 15).

(2) It is possible for one man to move a freight car with this tool. First release the brake on car; jam the point of bar under one rear wheel next to rail; apply downward pressure; work bar up and down with short strokes.

b. Bar (Hayward lock breaker).

(1) This tool is considered one of the handiest for use in forcible entry work It is often referred to as "claw tool," "lock breaker" and "door opener." It is actually a large size wrecking bar to which a few improvements have been added. It can be adapted to so many uses that only a few of the more important ones will be mentioned here.

(2) This tool is particularly effective in breaking locks, opening doors, forcing windows, lifting iron shutters, prying up rolling doors, prying up boards to get at fires underneath floors and around window frames, pulling metal ceilings, removing lath and plaster and ripping off shingles.

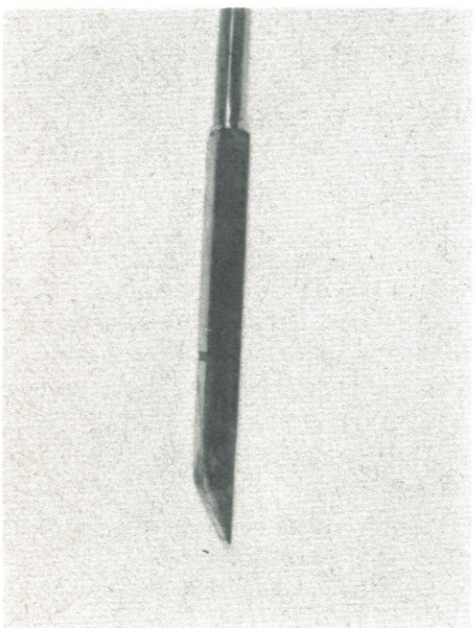


Figure 15.

Figure 16.

(3) Breaking a padlock or hasp is a simple task with this tool. Force the forked end of the tool over the bow of lock or hasp (fig. 16), then twist. The point of the hook may be inserted in the bow of the lock or hasp and leverage applied.

(4) In forcing doors inward or outward the forked end of the tool is forced between the door and jamb and the door pried open.

(5) In prying up planking, flooring, etc., the forked end of the tool is forced between the boards, preferably near the end, then pressure is applied downward.

(6) In removing hinges from doors and shutters, drive the forked end of the tool between the hinge and casement, then pry it off.

(7) In removing covers from manholes and street vaults, the forked end of the tool is forced between the cover and its casement, then pried downward.

c. (Kelly tool).

(1) The Kelly tool is a very useful tool in forcible entry work and is found in numerous naval fire departments (fig. 17).

(2) In opening doors that swing outward, the adz blade is driven between the door and jam near the lock or fastener, and the handle is drawn outward. This usually allows the door to open quickly by freeing the lock from the catch. Sometimes when this tool does not work in the manner described above at the lock side of the door, it can be driven in below or above hinges, on the hinged side, and handle pulled outward.

(3) This operation usually frees the door from the hinge or else the hinge breaks. This tool is quite effective for use where the space is limited, and can be driven with the use of a striking tool.

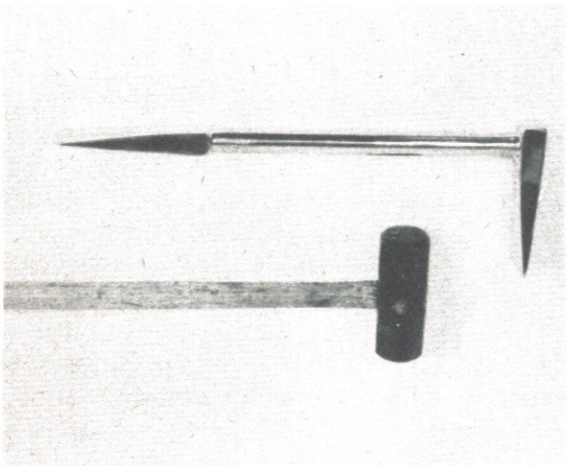


Figure 17.

3. Battering Ram

(a) This is a forcible entry tool used in opening heavy doors, breaching masonry walls, opening up for hose lines and rescue, and to provide drainage for water.

(b) In breaching masonry walls, after the first brick or stone is removed, work downyard, striking the wall with an upward lifting motion. Use the mammer head pick, pick head ax, sledge hammer, star drills, etc., to remove the first brick. Use the forked or pointed end of the ram when breaching (fig. 18).

(c) When forcing doors, the butt or ball end of the ram is used. Strike the solid portion of the door beneath the lock and not against the panel (fig. 19).

Figure 18.

(d) Two to five men can be used to operate this tool; in all cases, as a safety precaution when using as breaching tool grasp the second handle.

(e) Before breaching a wall to get to the seat of a fire, have charged hose lines in position for immediate operation.

Figure 19.

4. Belt (Life)

(a) Life belts are used principally when working on pomier ladders, sliding lifelines, lowering men over steep cliffs, effecting rescue, etc.

(b) The types of life belts in use throughout the naval fire departments are the Morrissey (fig. 20–A) and the Seagrave (fig. 20–B). The major difference between the two belts is that, the Seagrave has a plain snap while the Morrissey has a lever arrangement incorporated within the snap for checking speed when sliding a lifeline. Preference is given the Seagrave type for simplicity and ease of operation.

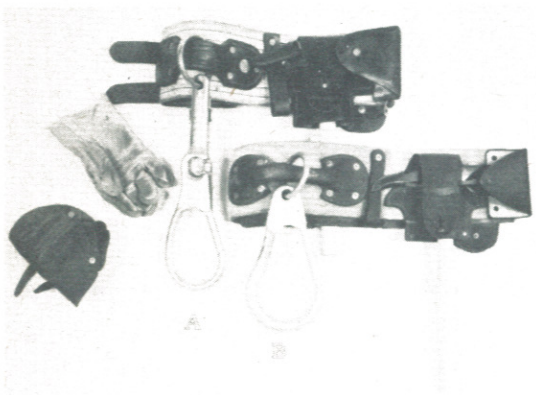


Figure 20.

(c) To don a life belt, grasp the buckles and snap in left hand; throw belt around body; fasten buckles, fasten the bottom buckle first to eliminate oversight of not buckling. Adjust belt to place snap in front of body. Gloves or palms shall be worn when sliding lifelines.

5. Chisels

(a) The chisels used in the naval fire department are of two types, the plain and short handled. They are used in forcible entry and rescue operations for cutting rivets, bars, hinges, padlocks, cement, masonry, planking, etc. When employed for these purposes they are struck with a sledge (fig. 21a).

(b) In using the chisels the person holding them keeps as far back as possible, extending the arm in line with the cutter to provide as much distance as possible between the tool and person holding it. The man swinging the sledge stands at a point at right angles to the chisel. In other words he does not stand in line with the man holding the chisel and the tool

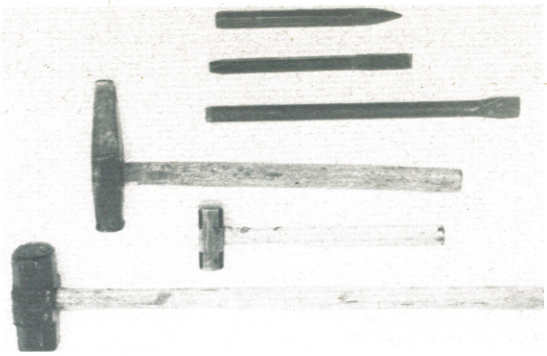


Figure 21a.

itself, but stands to one side so that in the event that the head of sledge comes off, there will be no danger of striking the man holding the tool.

6. Cutters

a. Cutters (acetylene).

(1) Cutting torches are employed in cutting through iron and steel when other tools are valueless or incapable of doing a given job in a reasonable amount of time. Their greatest value lies in rescue work when time becomes a matter of life or death. Torches used in the Navy are of the portable knapsack type, and are equipped with a high speed type burner (fig. 21b). Instructions for operating these torches are carried in each container.

Figure 21b.

b. Cutters (bolts).

(1) Bolt cutters are used for cutting iron bars, bolts, cables, etc. These cutters are not to be used on electrical equipment (fig. 22).

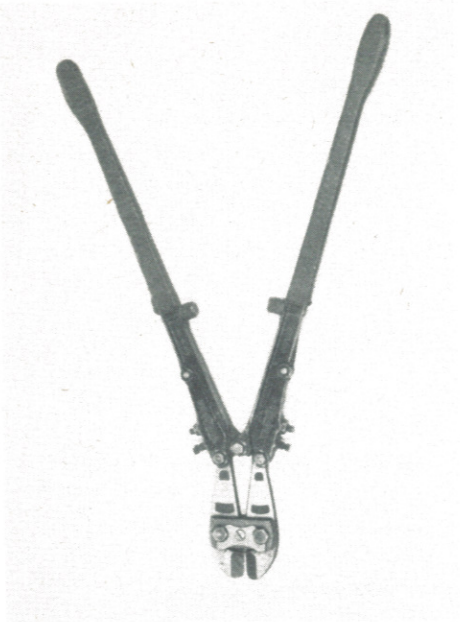


Figure 22.

c. Cutters (electrical).

(1) The Porter-type wire cutter, with finder hook and rubber insulated handles, is carried by a large number of naval fire departments (fig. 23).

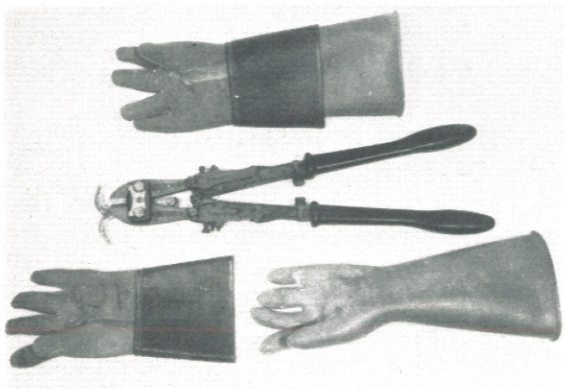


Figure 23.

(2) Due to deterioration the rubber handles often crack and are dangerous for use. Therefore, a rigid inspection is necessary in connection with this tool and the use of rubber gloves is mandatory.

(3) This type cutter is to be used for cutting copper wire only.

d. Cutters (tin).

(1) The purpose of these cutters is to remove or cut the tin on roofs. Ordinarily the tin is placed over the roof and on top of the tin is a layer of tar and gravel. Before using a tin roof cutter, scrape the tar and gravel away.

(2) Two types of tin roof cutters are in use (fig. 24). The rotary cutter rotates as the tool is drawn through the tin. To operate, drive the chisel side of the tool into the tin then turn the cutter over and insert the point of the cutter into the hole. Pull the tool toward you and the cutter will do the work.

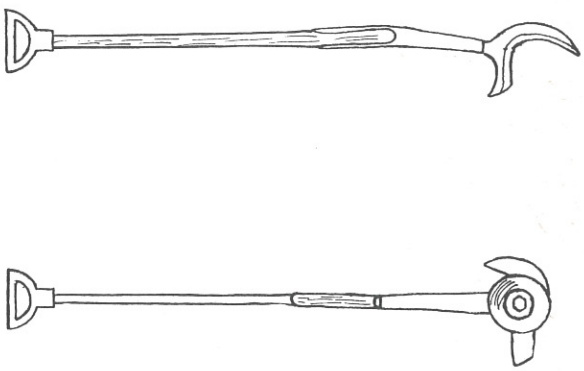


Figure 24.

(3) The other type is operated by driving the point of the tool into the tin and prying up sufficiently to get the point beneath the tin. The cutter is forced along in front of the operator and the tin is cut on the knife edge of the cutter.

e. Cutter (plaster hook).

(1) A tool designed for cutting metal lath and plaster, metal ceilings, etc., when making openings to get at fires and for the inserting of applicator operation and in overhauling operation.

(2) This tool consists of a pointed metal head. The head of the tool is fitted with blades which fold inward and snap open after penetration into the material to be cut or pulled down. The blades are sharpened on both edges (fig. 25).

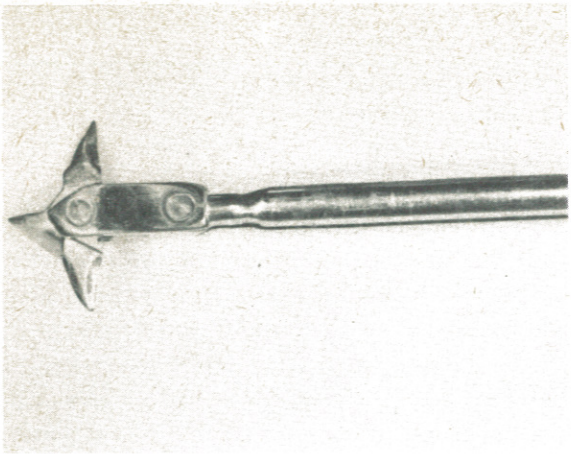


Figure 25.

7. Clamps (Hose)

a. Hose clamps are used to shut off the flow of water when replacing burst sections of hose, making tap-ins and extending lines without shutting off the water at the source of supply. A small, light weight clamp is also used in some departments as a regular practice in certain basic hose evolutions. (See Chapter 5, Charging Hose Lines, subpar. (b), p. 82.)

b. To operate the Peerless hose clamp, place clamp on ground with jaws open: insert hose in jaws approximately one foot from coupling on supply side; stand on foot piece; raise controlling lever slowly to limit of travel; make sure lock is engaged (fig. 26).

c. Clamp is placed as above mentioned, because, if hose is damaged by this tool, it can be repaired and only a foot of hose lost.

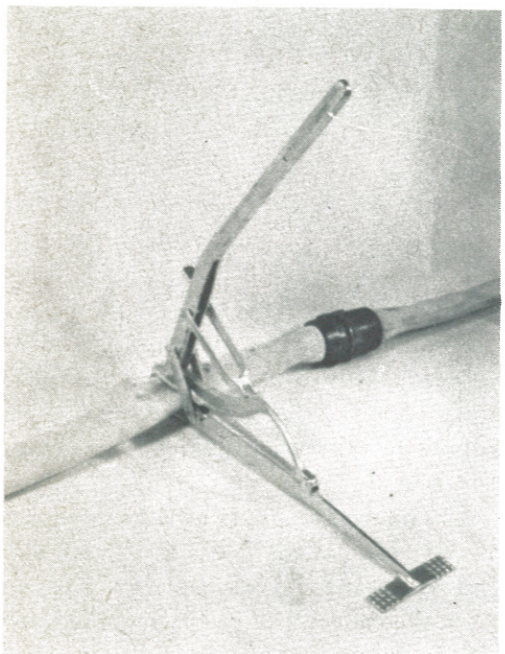


Figure 26.

8. Drills

a. Drill (star).

(1) A tool used for drilling holes in concrete, tile, brick, etc. To operate the drill is struck with a hammer and should be turned frequently to permit the cutting edge to come in contact with material at different points (fig. 27).

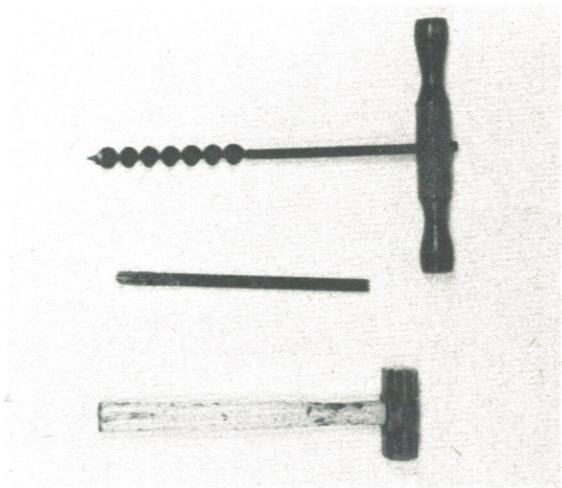


Figure 27.

b. Drill (auger).

(1) A wood boring tool for boring holes in roofs, floors, wooden tanks, etc., for the purpose of drainage or to make a starting point for saw.

(2) Augers in use drill a 2-inch hole and have a "T" handled shank.

(3) Avoid striking nails, bolts, knots, etc., when using an auger (fig. 27).

9. Door Opener (Detroit)

(a) A tool specifically designed for opening doors that swing inward, spreading door jambs, removing hinges and padlocks, and can be used as a crow bar to move heavy objects. Also, can be used as an improvised hose clamp.

(b) In placing the Detroit door opener into operation on a door that opens inward; measure the height of the door knob from the floor,

this being the correct distance to place the point of the bar out from the door, the length of the rod from the fulcrum to the compression piece may be adjusted by removing pin which is employed for locking the extension. (An axe must be brought along with the door opener in order to make a depression that will prevent the possibility of the point of the bar slipping when operating on such surfaces as concrete, etc. (fig. 29).

(c) In removing hinges or hasps, place the compression piece on the floor and the extension arm is adjusted so that the point of the bar is beneath the hinge or hasp. The application of downward pressure will either snap the screws, bolt or nails or will pull them out (fig. 28).

(d) It is sometimes possible in opening doors in frame buildings to spread the door

Figure 28.

jambs by inserting the Detroit door opener between the jambs even with the lock, extending the extension arm to the required distance and then applying pressure at end of leverage arms, thus springing the door jambs sufficiently to free the catch of lock.

(e) When making an improvised hose clamp, the bar is placed under the hose and the extension arm over the hose approximately one foot behind the coupling on the supply side. Place a hose strap under the bar, apply pressure to the extension arm to shut off the flow of

Figure 29.

water, secure extension arm to bar near compression piece with hose strap.

(f) The Detroit door opener can be used for moving heavy objects away from doorways, hallways, and in skidding stock during overhauling operations. Can also be used as a pry in various operations and it is possible to use claw end of bar similarly to a crow bar.

10. Drag (Scully)

(a) A tool constructed of small diameter pipe or iron rod in the shape of a "T." The head of the "T" has small eye bolts attached to form swivels on which are suspended treble or gang hooks. There are five of these gang hooks spaced evenly along the "T" head. A rope is permanently attached to the base of the "T" (fig. 30).

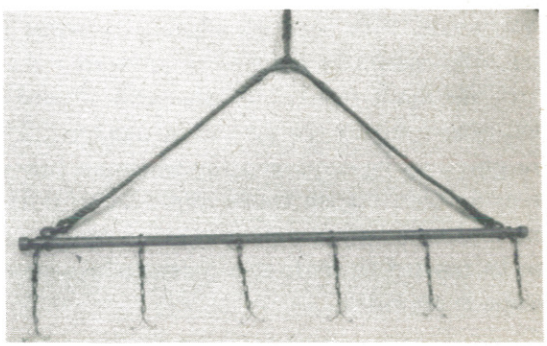


Figure 30.

(b) There are various methods of using this tool, for example:

(1) Stand on the shore, bank or edge of the body of water to be dragged; cast "drag" out; allow the "drag" to settle; pull "drag" slowly shoreward.

(2) Tie a second rope to the "drag" where the 2 pipes or rods unite; 1 rope is controlled by a man on shore, the other by a man in a boat off shore; pull drag back and forth slowly, moving it laterally after each trip to avoid dragging the same area twice.

(3) The use of 2 ropes and 2 men on opposite banks of a body of water to be dragged is most effective provided the distance is not too great.

(c) This tool was designed for one specific purpose; to drag for submerged bodies.

11. Gloves (Rubber)

(a) Rubber gloves are employed in connection with electrical wire cutters for severing live wire. They provide an additional safeguard in the event that the insulation on the handles of cutters is cracked or deteriorated. They are also effective in the rescue work of persons caught by live electrical equipment.

(b) The rubber gloves used in the naval fire department are of the gauntlet type and shall be tested every 60 days to withstand a voltage of 10,000. Wrist-length leather gloves are furnished with all rubber gloves and are worn over rubber gloves to protect same (fig. 23).

(c) Care must be taken to touch only one wire at a time, and when cutting wires, stand on a dry object, preferably a ladder.

12. Gun (Life) [1]

a. General Descriptions.

(1) The life gun (fig. 31) is used to shoot a projectile, with cord attached, to persons in peril who cannot be reached in any other way. A lifeline made fast to the other end of cord is then drawn up by the person in danger. The life gun may be employed for getting a line to firemen operating on roofs, and after the lifeline is drawn up, various pieces of equipment can be hoisted to roof, or a means of rescue or escape is provided.

[1] (This is not a standard piece of navy fire fighting equipment, and should be procured only on the recommendation of the District Fire Marshal.)

(2) Each gun is equipped with different size charges, full loads, three-quarter loads and half loads, giving a choice of charge to use according to the height of the building. It is always best when firing the gun to work from the windward side of the building when such is possible. This will make sure that the projectile goes over the building and reaches the people thereon. The cord used in connection with the life gun is carried coiled in a canister which prevents it from becoming fouled.

Figure 31.

b. Operations.

(1) Remove lid from cord canister, attach inside end of cord to projectile. (See knots.)

(2) Place lifeline in position and attach outer end of cord to eye of lifeline.

(3) Place projectile in gun barrel.

(4) Load gun with proper charge. BE SURE THAT PROJECTILE IS INSERTED ACCORDING TO INSTRUCTIONS FURNISHED WITH LIFE GUN.

(5) To fire gun stand firm on feet and hold gun tight to shoulder, aim at cornice, then elevate the aim to a point 15 to 20 feet out from edge of building. (Operator should not stand over 50 feet out from base of building.)

(6) Both gun and projectile should be well cleaned and oiled after use, also, care must be exercised in recoiling cord in canister.

13. Hooks

a. Hooks (grappling).

(1) This tool consists of three steel hooks, the long shanks of which are welded together

and end in an "eye." To this eye a length of steel cable or chain is permanently attached.

(2) The hook is used for pulling baled goods, unsafe walls and partitions and in dragging for submerged bodies or objects. Crash apparatus employ this tool for towing and pulling aircraft during emergency operations (fig. 32).

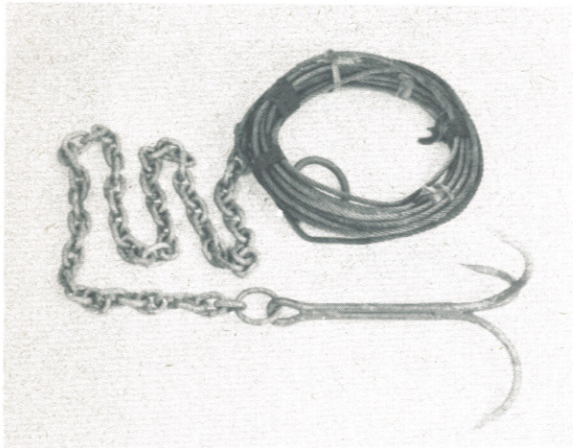


Figure 32.

b. Hooks (pull down).

(1) A tool consisting of a steel hook with chain attached and a detachable wooden handle. It is used for pulling down unsafe walls and partitions (fig. 33).

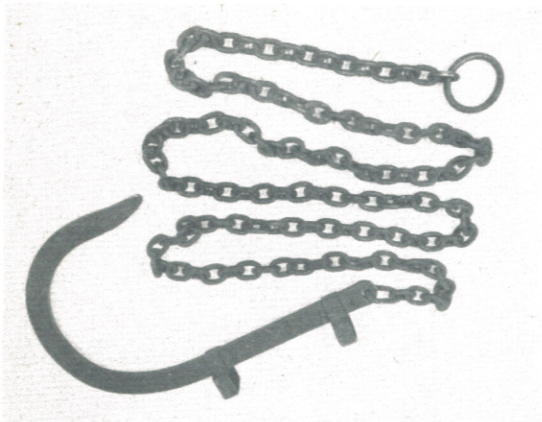


Figure 33.

(2) To operate this tool, tie a rope to end of chain; insert handle in hook; lift hook over wall; remove handle; pull on rope.

(3) In emergencies, where sufficient manpower is not available, the rope can be tied to apparatus to obtain the necessary pull.

Figure 34.

14. Nets (Life) [2]

The life net (fig. 34) is a device used for rescuing persons in peril on upper floors or roofs of buildings when all other means are impractical.

15. Pick (Hammer Headed)

(a) A tool incorporating the advantages of both pick and light weight sledge. It is used in various types of heavy duty prying and digging operations.

(b) The hammer head makes it possible to use a sledge in combination with this tool (fig. 35).

Figure 35.

[2] (This is not a standard piece of Navy fire fighting equipment and should be procured only on the recommendation of the District Fire Marshal.)

16. Pinch Off (Refrigeration)

(a) A device, resembling pliers, which crimps tubing on supply side of break and locks itself in place to cut off flow of refrigerant gases.

17. Poles

a. Poles (pike).

(1) This tool has a wide variety of uses some of which are: removing lath and plaster, corrugated iron walls and roofs, pulling metal ceilings, overhauling piled material and debris, improvising stretchers, improvising water drains with salvage covers, opening windows in ventilating, etc. Poles of varying lengths are in use (fig. 36).

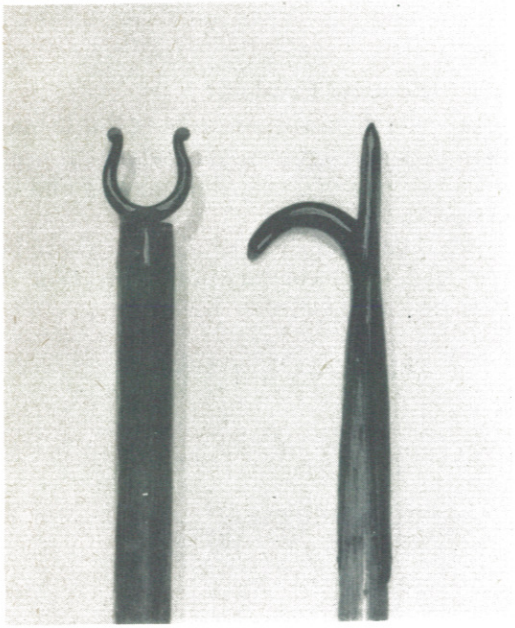


Figure 36.

b. Poles ("U").

(1) A wooden pole with a metal head in a shape of a "U", used in bracing ladders (fig. 36). Infrequently used by Navy fire companies.

18. Rollers (Hose)

A device used when lowering or hoisting equipment to higher levels on buildings or roofs. Its use prevents cutting and chafing of hose or rope on sharp cornices, etc. (fig. 37).

Figure 37.

19. Sledges

A tool used in forcible entry, rescue and ventilating operations where considerable weight and striking power is necessary to break dead lights, concrete, brick, tile and to bend iron and steel bars. Various weights are in use (fig. 38).

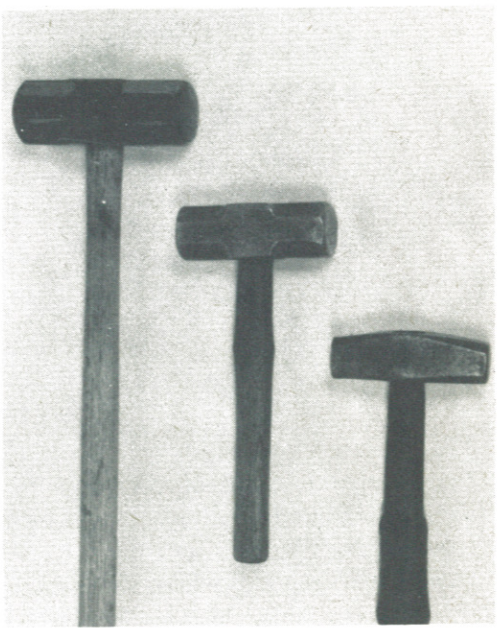


Figure 38.

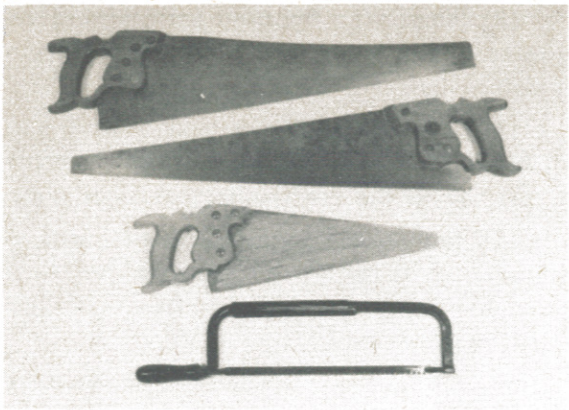


Figure 39.

20. Saws

(a) Saws of various types are employed on occasion for rescue, forcible entry, ventilating and overhauling operations.

(b) Rip saw for cutting wood with the grain (fig. 39).

(c) Crosscut saw for cutting wood across the grain (fig. 39).

(d) Hack saw for cutting metal such as iron bars, bolts, etc. (fig. 39).

(e) Sheet metal saw, as the name implies, for cutting sheet metal, nails, etc. (fig. 39).

21. Shovels

(a) Various types of shovels are provided for digging, removing debris, overhauling, salvage and extinguishing operations.

(b) Square point may be equipped with either long or short handle. Both types are in use. These shovels are used to the best advantage on flat surfaces during overhauling operations when removing debris (fig. 40).

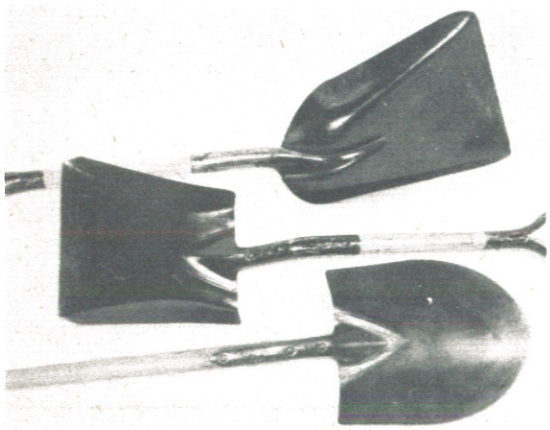


Figure 40.

(c) Round point shovels are designed for digging. They are considered the most practical for use in fighting brush and grass fires (fig. 40).

(d) Scoop shovels are used for spreading and removing sawdust, carrying debris, digging in loose bulky material and for removing water from floors and floor coverings (fig. 40). The covered scoop is best suited for bailing water.

22. Straps

a. Straps (hose).

Hose straps are used for securing hose to ladders, fire escapes, hose rollers, for assisting in handling of hose lines and for use in improvising a step ladder or a hose clamp (fig. 41).

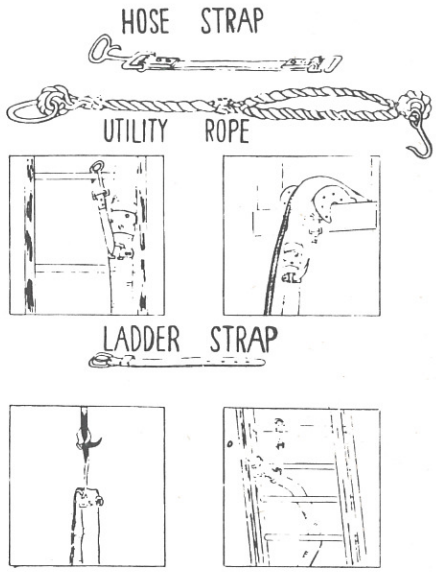


Figure 41.

b. Straps (ladder).

Ladder straps are usually carried strapped to the two bottom rungs of the "fly" on extension ladders, it is used to strap the "fly" to the main ladder or the "fly" to fire escapes balcony railings after the ladder has been raised and placed into position. Its use insures additional security to men working on or climbing extension ladders (fig. 41).

0306. ROPE AND KNOTS

1. General Description

a. Rope (size and use).

Ropes most commonly used in the naval fire departments are one-half inch and three-

fourths inch in diameter. Rope one-half inch in diameter is used on suction strainers, hose rollers and as ladder halyards; rope three-fourths inch in diameter is used for lifelines, equipment and for providing fireline barriers.

b. New Rope (stretching).

(1) New rope is stretched before being placed in service. This is accomplished by securing the ends between supports and attaching a weight in the middle; another method is to hang the rope double in a hose tower, allowing both ends to hang down and attaching a weight to them. Usually new rope will be fully stretched in a period of 7 to 10 days.

(2) Rope used for lifelines and equipment should have an "eye" spliced in one end (the "eye" should be approximately 2 inches in diameter with a tapered 6-inch splice) the opposite end should be "spliced" or "served" to prevent unraveling.

c. Rope (coiling).

(1) Each fire department should be equipped with a standard rope coiler. It is used to coil both equipment and lifeline rope in a standardized manner. Rope coiled on a standard rope coiler is easily carried and the danger of it becoming fouled is eliminated.

(2) Rope coiled in this manner is not suited for throwing any great distance in an upward or outward direction. For dropping a rope from upper floors or roofs it is ideal.

(3) For throwing a rope a more practical method will be explained in a following paragraph.

d. Rope (knots).

(1) In fire department service a knowledge of rope, knots and their proper application is very essential. Many times an improperly tied knot or hitch may result in the failure of an evolution, the satisfactory completion of which is so necessary for saving of life and property.

(2) The use of rope and lines in handling certain fire department equipment is so essential that firemen should devote sufficient time in perfecting themselves in the handling of rope and the tying of knots, bends and hitches.

(3) There are a few basic principles in the construction of knots, bends and hitches which, if well understood, make knot tying easy.

(4) There are numerous kinds of knots and hitches of which various applications are made by firemen in the performance of their duty.

(5) Names and terms commonly used in connection with the use of rope in making knots throughout naval fire departments are as illustrated in this chapter.

(6) The above will be treated under three classifications namely; knots, bends and hitches. A knot, bend or hitch is defined as a lump or knob formed by interweaving the parts of a cord, rope or other flexible body; or any tie or fastening formed with rope, cord, etc., and is intended to be more or less permanent in nature.

2. Coiling Rope With a Rope Coiler

(a) The coiler consists of a base with two 2-inch pipes, 2½ feet in height and a 24-inch center (fig. 42).

(b) The coil is started by placing the "eye" over the left coiler post (fig. 42).

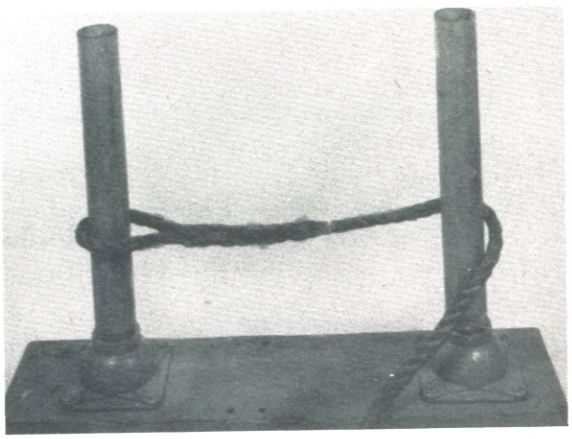


Figure 42.

(c) Six wraps are made horizontal and parallel to each other working upward (fig. 43). Five more wraps are made in succession on top of the 6 previous wraps, starting at bottom and working upward, which gives a total of 11 wraps (fig. 43).

(d) The next step is to bring the 12th wrap on a plane with the first 6, the 13th wrap to be placed on the 12th; continue in a like manner

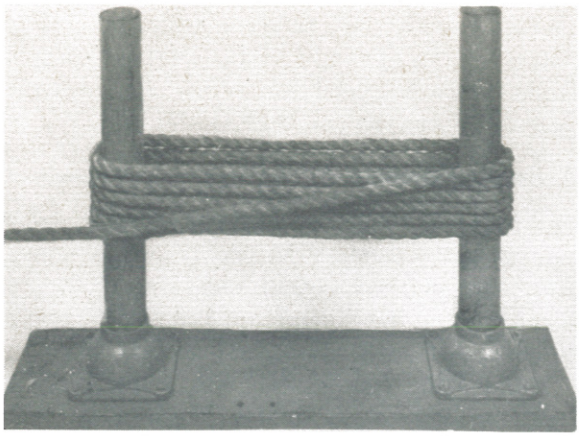


Figure 43.

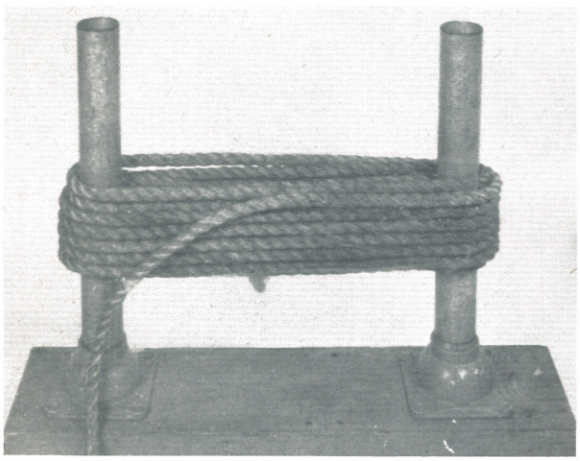


Figure 44.

until sufficient rope remains to complete the vertical wrap and sling (fig. 44).

(e) Next bring the rope to the starting post of coiler, to a point approximately 1 inch from the post and make a breaking point (fig. 45), painting a mark on the rope at this point makes identification easy when rope is recoiled (fig. 45).

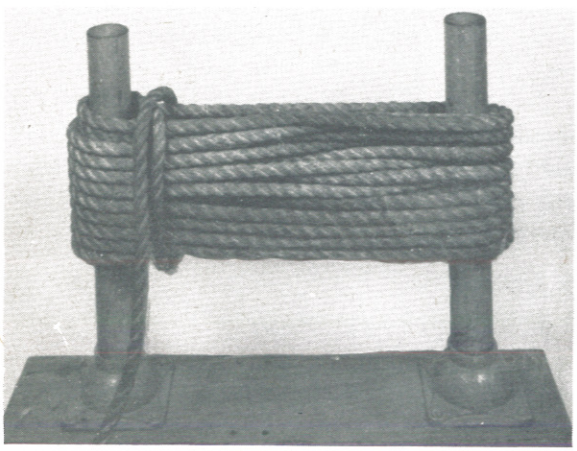


Figure 45.

(f) Proceed to wrap in a circuitous manner to the right, the 2d wrap binding the first; continue until approximately 1 inch from right coiler post (fig. 46).

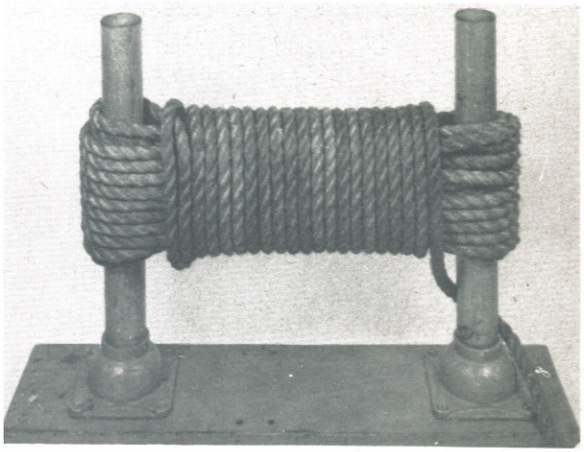


Figure 46.

(g) Remove the coil from the coiler, by lifting both ends evenly, lay it upon the floor, double the remaining rope and pass it up through the aperture on the right side of the coil, adjust and pass down through aperture on left side, pass single end of rope through loop and pull loop tight (fig. 47).

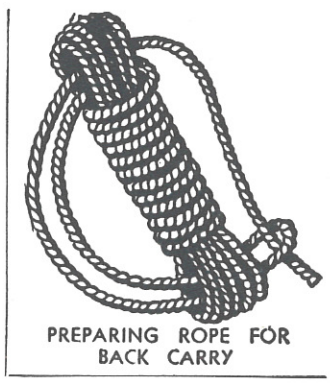


Figure 47.

(h) Rope coiled in this manner can be carried on the back of the wearer the same as a knapsack, allowing him the free use of both hands (fig. 48).

Figure 48.

3. Preparing Rope for Use

(a) To prepare the rope for use, remove the end from the double loop and then remove the sling from both apertures, coil the sling rope in order that it may be thrown with main coil.

(b) Grasp the "eye" (should be painted red for easy identification) and pull sufficient rope from center of coil for securing (approximately 3 loops). This loosens up coil so rope will pay out and give sufficient for securing (fig. 49). Secure rope, then drop or throw main coil and extra sling rope from building. (In throwing, aim the coil at the point desired.)

(c) For shooting the lifeline the action is the same with the exception that the coil is placed on the ground and the life gun cord is made fast to the eye of the lifeline, the rope then pays out from the coil without fouling.

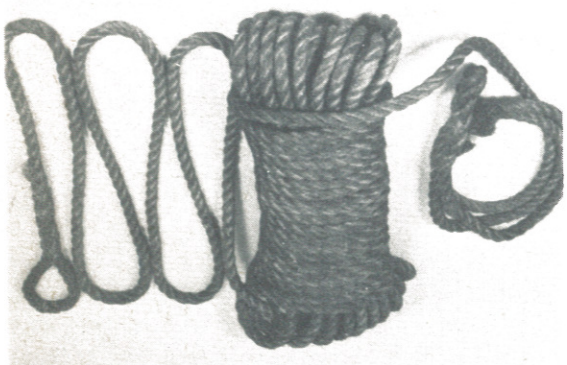


Figure 49.

4. Rope (Coiling for Throwing)

(a) For throwing, remove sufficient rope in regulation manner to reach desired point. Hold rope in hand; coil in loops about 3 feet in diameter, leaving enough rope at end to make 10 or 12 coils about 12 inches in diameter.

(b) Bind small coils with a bight; hold rope on both sides of the bight (fig. 50).

Figure 50.

Throw small coils at the objective, allowing the large coils to pay off other hand; retain hold on rope.

(c) In this method of throwing a rope, the small coils supply the weight necessary to carry the rope to a given point, with practice, a rope can readily be thrown approximately 50 feet horizontally.

5. Lifeline

a. Lifeline (use). Rope

(1) Lifelines are used to provide a means for men on upper floors or roofs of buildings to effect rescue of others or to allow them to reach the ground with safety during extreme emergencies.

(2) A lifeline and lifebelt can be used effectively in making rescue over steep cliffs, or a man can walk down the face of a building performing rescue or ventilating operations at any desired floor.

(3) When sliding a lifeline, a lifebelt, leather gloves or palms should always be worn if they are available.

b. Lifeline (slide).

(1) Secure lifeline to any substantial anchorage; drop other end to ground; stand near edge of roof, window or cliff.

(2) Face the lifeline; grasp line in left hand; snap hook of lifeline with right hand; hold line and hook in right hand.

(3) Place left hand on line above hook; pull up slightly and throw loop around hook; with left hand grasp the top portion of hook and raise hook with left hand as high as possible on line, allowing lifeline to slip through hook, with right hand below hook on line exerting tension.

(4) Place left hand high on line above hook; place right hand on line below hook and well back on hip.

(5) Back out of window or off roof, ledge, etc., keeping tension on line with right hand (fig. 51).

Figure 51.

(6) Walk down face of building or cliff a few feet and then kick clear, releasing tension on line with right hand.

(7) Speed of descent and ability to stop at any desired point is controlled by the right hand.

6. Uses (Rope and Knots)

(1) Figures 52 through 69 illustrate the most common uses of rope in fire department operations.

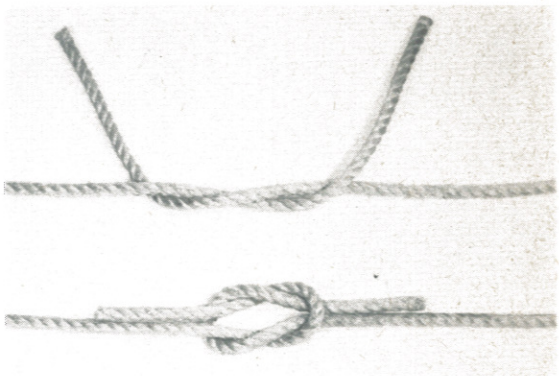


Figure 52. Square knot used in tying bandages in first aid work.

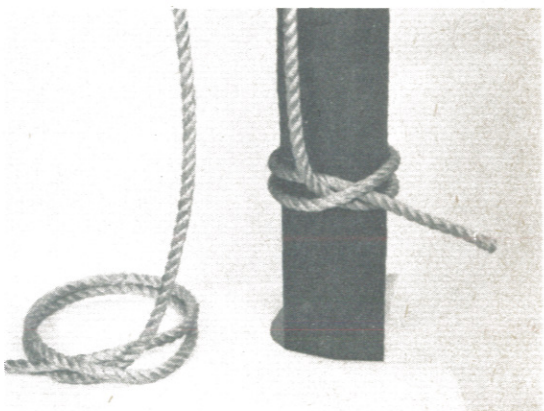


Figure 53. Clove hitch used in sending aloft equipment.

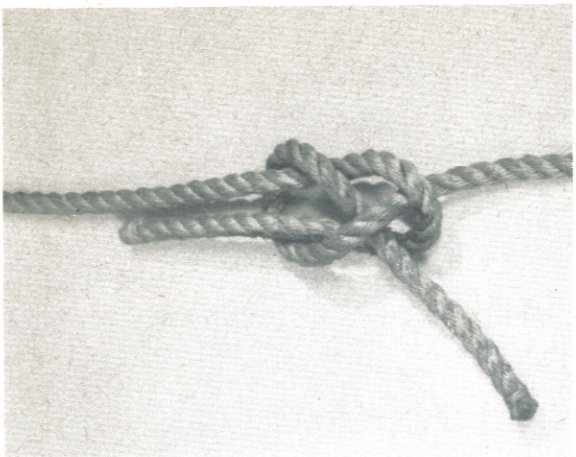


Figure 54. Becket bend used for securing two lines together.

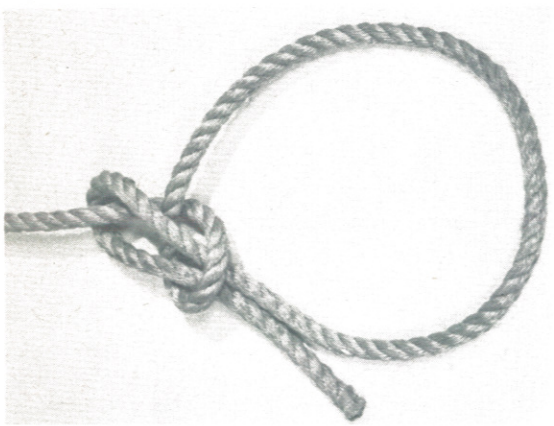


Figure 55. Bowline knot used in securing a line in many instances.

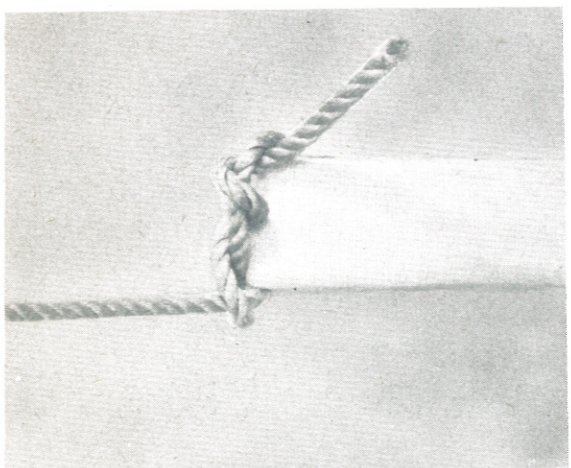


Figure 56. Timber hitch used in hoisting empty lines (6 feet back of coupling).

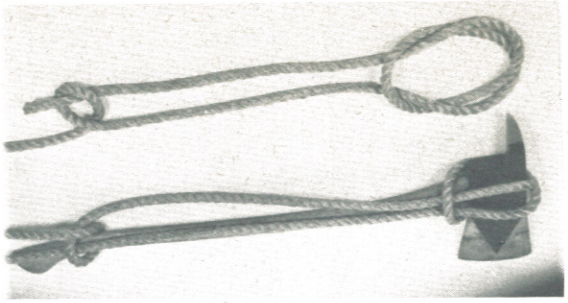


Figure 57. Double loop crossed and half hitch, used in sending an axe or sledge aloft.

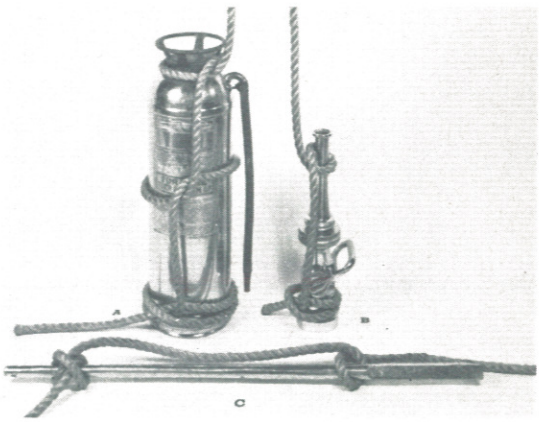


Figure 58. Clove and half hitch, used in sending an extinguisher, nozzle, or crowbar aloft.

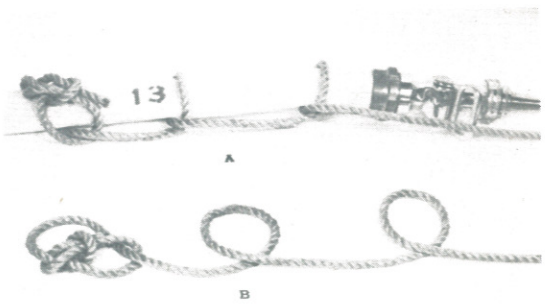


Figure 59. Running bowline and two half hitches used in sending a loaded line aloft. Running bowline 15 feet back of coupling, half hitch 7½ feet back of coupling and another half hitch back of coupling. An additional half hitch is placed on nozzle tip when lowering.

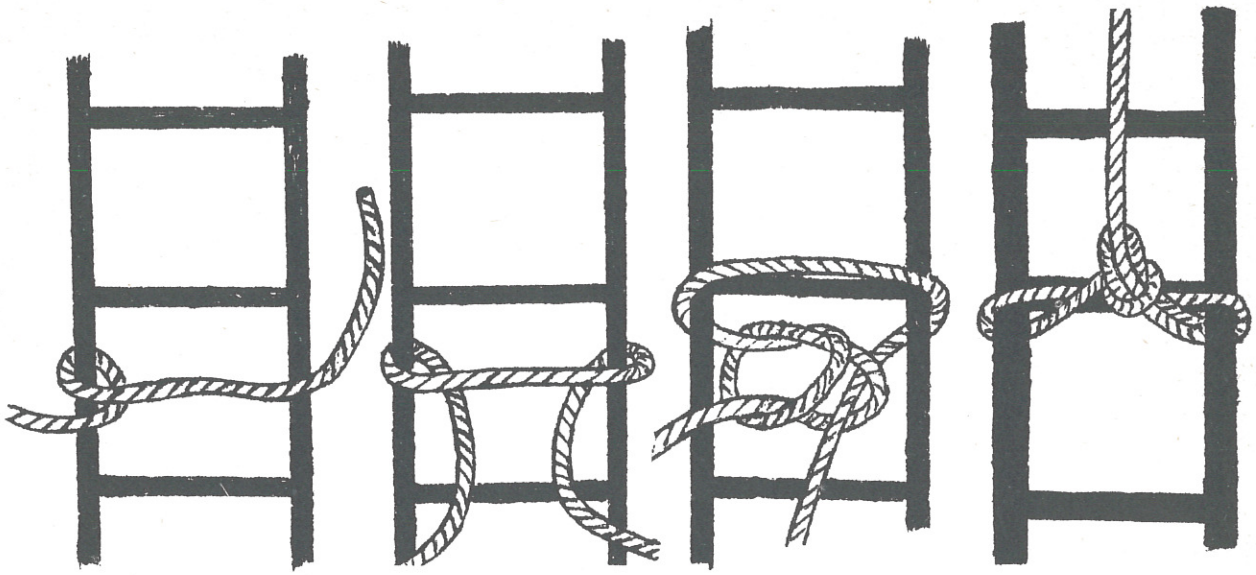


Figure 60. Start rope around beam and out front side.

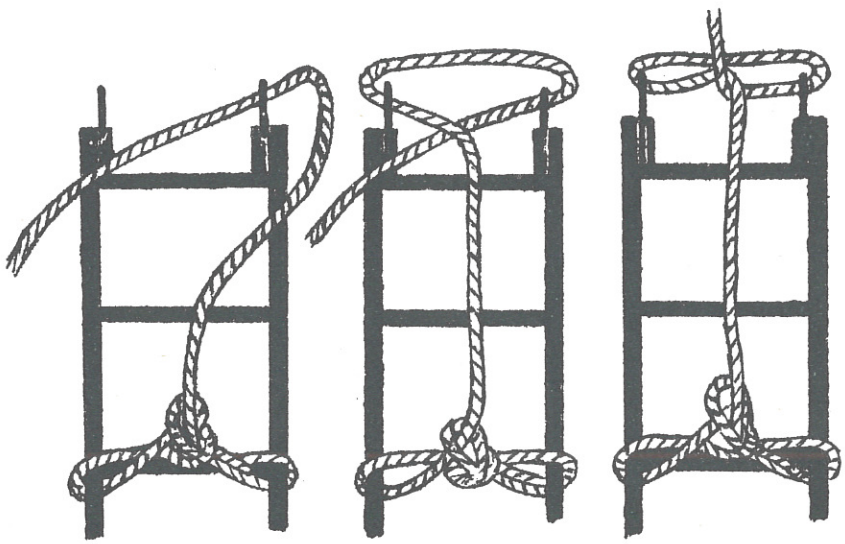
Figure 60b. Continue with rope around opposite beam bringing it out behind the cross rope.

Figure 61. Form knot with the hand next to ladder while facing top of ladder, and end is passed through.

Figure 61b. Knot is then pulled taut and lays just above the cross rope.

Figures 60, 60b, 61, 61b. Bowline used in sending a ladder aloft.

(2) The correct distance for tying the bowline on all ladders, except roof ladders, is found by dividing the length of ladder by 5 and multiplying by 2. In hoisting ladders to the roof the rope should be between ladder and building. When lowering, ladder should be between rope and building.



Figures 61c, 61d, and 62. Bowline knot and half hitch as used on roof ladder.

(3) To send roof ladder aloft, open hooks on ground, place bowline behind third rung and a half hitch on hooks.

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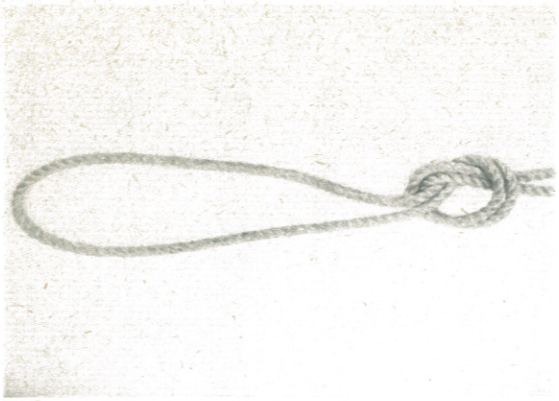

Figure 63. Bowline on a bight, form a loop approximately 3 feet in length, overhand knot is placed in looped end.

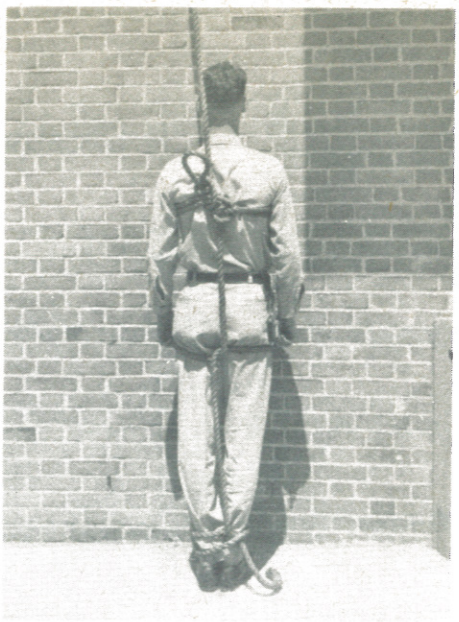

Figure 66. Rescue knot, for man or woman, clove hitch around ankles, half hitch beneath hips, two half hitches under arms. Form a loop and come up on opposite side behind half hitches and throw a half hitch over loop. If necessary spread hitches in front of breast.

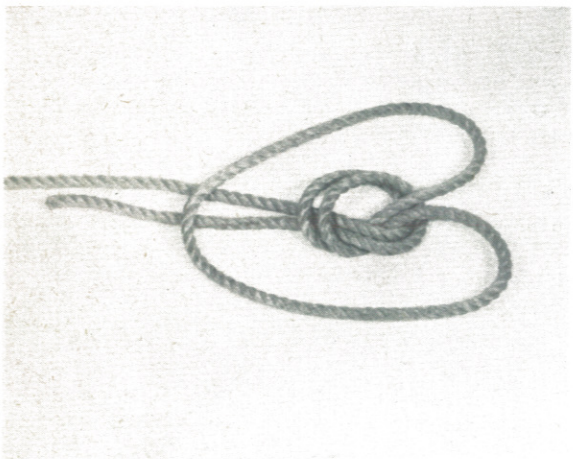

Figure 64. A loop is placed over the overhead knot, the bight is drawn down to the overhand knot.

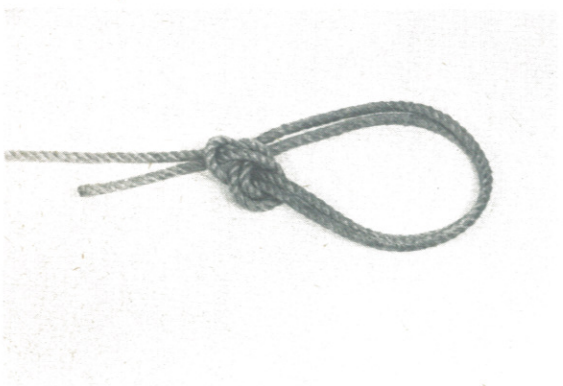

Figure 65. Leg loops formed in preparation for lowering and hoisting firemen.

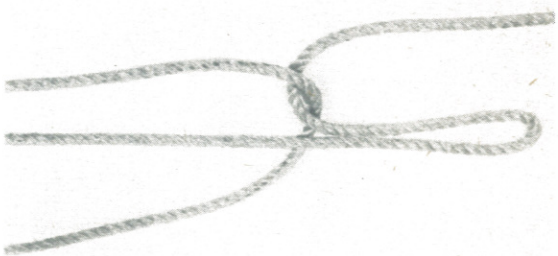

Figure 67. Hose roller knot, place rope around object and pass over main rope. Main rope is grasped behind the cross rope and slack is taken and brought forward.

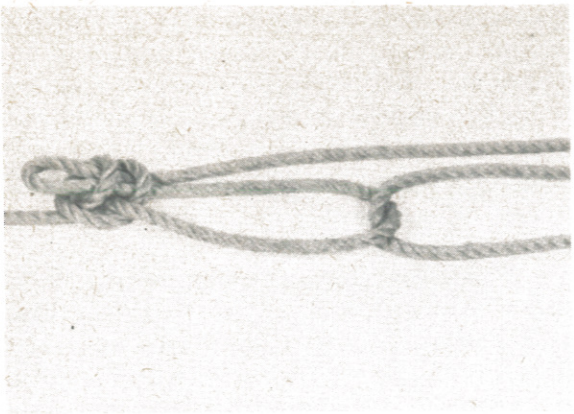

Figure 68. Bring loop forward and place two half hitches over loop. Secure the taut rope by a bight.

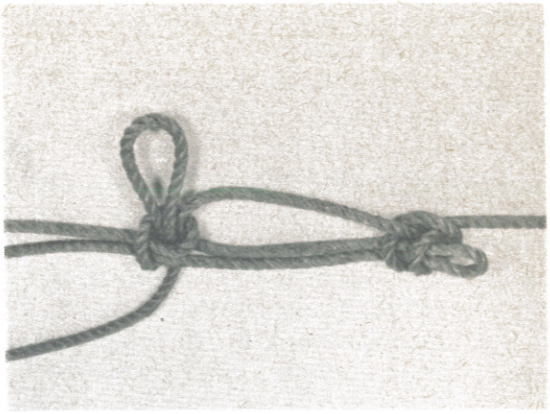

Figure 69. Shows the securing knot after tension is taken.

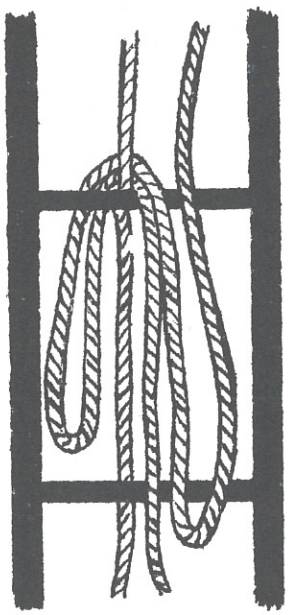

Figure 69b. Start over the fourth or most convenient rung with a bight.

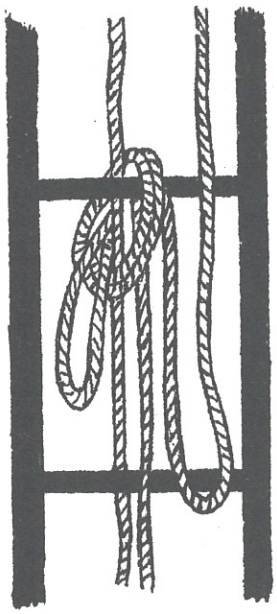

Figure 69c. Hold bight taken, then throw a half hitch over bight.

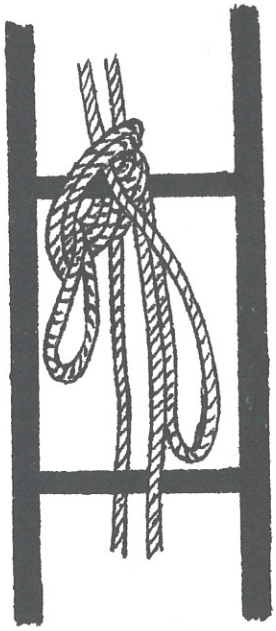

Figure 69d. Hold half hitch, then throw the second half hitch and include the slack rope in this hitch.

Figures 69b, 69c, 69d. Show the Bangor Knot which is used to secure fly on some extension ladders and to prevent loose halyard fouling or becoming a hazard at base of ladder.

0307. BREATHING APPARATUS AND GAS MASKS

1. General Information

a. For the purpose of saving life or extinguishing fire, firemen are frequently called upon to enter premises charged with noxious gases or smoke in such concentrations as to make it unsafe without some form of respiratory protection. In some concentrations of certain gases even a few breaths mean certain death.

b. Breathing apparatus offering such protection are regular equipment on Naval Fire Departments. Their use and maintenance demand a complete and thorough knowledge of

the mechanics, limitations and proper wearing of each type of mask.

c. Particular attention should be given cleaning and maintenance instructions. Proper servicing has a material effect upon operation and protection. Wearing a mask will slow a man up, but it is much better that he work at reduced efficiency than not at all.

d. Situations requiring use of breathing apparatus are usually hazardous. A man's life may be dependent upon his thorough knowledge of the equipment and proper use of the lifeline. The principal need is proper training in use of the various masks in use by the department. Men should drill while wearing masks under as near actual emergency conditions as possible. This should include climbing stairs, ladders, handling hose lines, moving objects and simulating rescue with another member as the victim. The use of blindfolds would be similar to conditions encountered in a basement charged with dense smoke which a light could not penetrate. This would teach members to "feel" their way and not fall into holes, also to retrace their steps and find their way out. Good practice, under some conditions where vision is impaired, is to count your steps going in and recount them coming out; as from a ladder, hatchway, etc.

e. With drills conscientiously performed members will experience most of the difficulties that might cause panic under actual operating conditions. Many a man has thought himself in trouble because of some new and unexpected circumstance encountered while wearing breathing apparatus under emergency conditions. This could be prevented through proper training.

f. When situations call for quick thinking and cool headedness on the part of the wearer, previous training and familiarity with the equipment will help him react properly. The following suggestions have been found helpful:

(1) At emergencies, requiring the use of breathing apparatus, men should always work in pairs. One can then aid the other in case of trouble and there is less chance of losing track of an odd man.

(2) If due to physical exertion the breathing apparatus does not supply oxygen in the quantity which one seems to require, he should try shallower inhalations. Oxygen breathing apparatus supplies approximately 100 percent oxygen compared to 20 percent oxygen in ordinary air. Even though the wearer may not be able to breathe as deeply as he would like there is more than ample oxygen being supplied. With any breathing apparatus if actual resistance to breathing is encountered, retreat immediately to outside air.

g. In atmospheres containing irritant gases, such as ammonia and sulphur dioxide, rubber bands placed around trouser legs and shirt sleeves will prevent burns to wearer's crotch and armpits. It is good practice under these conditions to smear grease on the moist portions of the body.

h. The wearer may become nauseated and have to vomit because of heat exhaustion, putting mask on in foul air, breathing through nose, etc. If necessary to vomit, start for the outside, take a deep breath, pull facepiece to one side, CAUTION—(When wearing OBA grasp the inhalation tube so it is closed to the passage of air, before pulling facepiece to one side) vomit, then immediately replace facepiece. Refrain from breathing any foul air if possible.

i. When necessary to retreat to outside air, give proper signal on lifeline. Always let your partner know what you intend doing. Do not separate. When rapid retreat is necessary, both men should pay particular attention to keeping slack from lifeline to avoid fouling of line. If lost or unable to see, follow lifeline, hose line or recount steps to outside.

j. In the event of mask failure, Do Not Remove in Foul Air. It is better to give the "Help" signal, start for the outside and if you cannot make it go down with the mask on. Complete failure of the mask is almost impossible; your chances of being revived are greater by keeping mask in place, as partial protection will be afforded.

k. Where it is necessary for the wearer to go in a considerable distance or around obstacles that might interfere with transmission of signals, other men equipped with masks can be spaced at intervals to relay signals. The lifeline is used to provide added safety to the wearer and its use depends upon the situation at hand. Through it the wearer has constant communication with men on the outside. It serves as a safety line when working in areas

where pits, elevator shafts, open hatchways, etc., may be encountered. It can be used by the wearer to find his way outside and will aid members on the ouside in rescuing a wearer in distress.

CAUTION: Observe care when dragging a man out by use of the lifeline as obstructions may injure him or pull his facepiece off. It is better to send in other men equipped with breathing apparatus to assist in his removal.

2. Communication

a. A definite tug on the line is used to relay signals. This is accomplished by a full swing of the arm to prevent signals from being confused with jerking of the line occasioned by the normal movements of the wearer. Signals must be pronounced and definite to be felt at ends when line has passed around corners or obstructions.

b. Slack Must Not Be Allowed in Line. The wearer and line tender must be alert at all times for signals and answer all signals promptly. All signals shall be obeyed at once except the signal to advance in which case the wearer should use his own discretion. Signals may originate from wearer or line tender and the "OK" signal should be given frequently. Failure to receive an answer to the "OK" signal from the wearer shall be cause for immediately starting action to get the man out. Do not wait for the "HELP" signal.

c. When a wearer fails to receive an answer to his signals he will notify his partner, start for the outside and continue to fresh air, unless able to re-establish signals enroute.

d. The line tender must be alert at all times and watch for the possibility of a man inside being cut off due to spread of fire or collapse of the building. He must not leave the lifeline unattended. One man shall not tend more than one lifeline.

3. Signals

A standard set of lifeline signals is in use and shall be memorized by all members.

Code	*Tugs*	*Meaning*
O	1	OK.
A	2	Advance.
T	3	Take-up.
H	4	Help.

O—Everything all right give frequently.

A—Going ahead; wearer will pull line. Man outside let slide through fingers.

T—Backing out; retreating; moving position. KEEP SLACK OUT OF LINE.

H—Emergency; Assistance needed. If from inside send in men with masks. If from outside, wearer to come out immediately.

4. General Classification

Breathing apparatus are manufactured in many types and designs but all of them may be placed in one of three distinct classifications:

a. Filtration and Absorption.

With masks of this type, the wearer, upon inhalation, draws the outside air through a canister containing chemicals that filter or absorb noxious gases injurious to respiration. Exhaled air is exhausted to the outside. Enough oxygen to sustain life must be present in the foul air. This condition is present in the majority of cases requiring the use of breathing apparatus. However, it is not always possible to determine this. This type mask should never be used in such places as tightly closed rooms, closed cellars, sub-cellars, holds of ships, tunnels, etc., where there is little or no ventilation. If there is dense smoke and only smoldering combustion it is likely there is not enough oxygen present to support life. When wearing a filter type mask, labored breathing or the odor of gases coming through the mask would indicate the wearer should immediately return to the outside, holding his breath if possible. Under these conditions the use of a self-contained oxygen or a compressed air breathing unit or a hose mask is indicated.

b. Hose Masks.

The operating principle of all masks under this classification is the same. A blower operated either manually or electrically is capable of furnishing the wearer with a constant stream of fresh air through a hose. Exhaled air is exhausted to the outside. These masks are the most comfortable to work in but the wearer is limited in the distance he can travel from the blower. Hose furnished with masks of this type rarely exceed a total length of 150 feet. Lightness and compactness make these masks ideal for use in tank cars, manholes, street vaults, etc.

c. Self contained.

This classification includes those apparatus in which the wearer carries his own oxygen or compressed air supply and is entirely independent of the outside air. Pure oxygen under high pressure in cylinders is reduced by suitable mechanism to a breathable pressure. In some apparatus the exhaled air is exhausted to the outside. In others the exhaled air passes through chemicals that remove moisture and most of the carbon dioxide, then recirculates through the apparatus. Provision is made whereby the wearer can exhale to the outside air should resistance to breathing occur.

CAUTION—NO BREATHING APPARATUS OFFERS COMPLETE PROTECTION IN ATMOSPHERES CONTAINING HYDRO-CYANIC ACID GAS. THIS GAS IS ABSORBED THROUGH THE UNPROTECTED PORES OF THE SKIN!

BODY PROTECTION IS NECESSARY WHEN ENTERING HIGH CONCENTRATIONS OF IRRITANT GASES!

5. Description of Standard Navy Equipment

It is evident that to protect the firefighter against the hazards he will encounter occasionally while carrying out his duty, some means must be provided either to filter the harmful agents out of the air or provide a supply of oxygen independent of the surrounding atmosphere.

The oxygen breathing apparatus, Type A–1, was developed primarily for shipboard use. However, it is used widely in structural fire fighting, particularly on activities of the Naval Shore Establishment. Its use ashore has been encouraged, in view of the Navy's program of standardization and economy. Requisition for self-contained oxygen or compressed air supply type units or hose masks may be made, however, with the recommendation of the District Fire Marshal, where local conditions require the use of types other than the Standard Navy equipment described below.

6. Oxygen Breathing Apparatus, Type A–1

a. Description.

(1) The apparatus described and illustrated in this manual is known as the Navy oxygen breathing apparatus—type A–1. It is a self-contained apparatus and operates independent of the outside air. The apparatus employs a canister filled with a special chemical which absorbs carbon dioxide and simultaneously evolves sufficient oxygen for the wearer's respiratory requirements (fig. 70).

Figure 70.

b. Construction.

(1) For the performance of its vital function, the Navy oxygen breathing apparatus has within its structure:

(a) A means of supplying oxygen (chemicals).

(b) A means of purifying exhaled air (chemicals).

(c) A means of cooling exhaled air; radiation from the breathing bag and tubes.

(d) A means of storing reserve air that has been made ready for rebreathing (a breathing bag), since only part of the air in the system is in the lungs at any one time.

In the Navy oxygen breathing apparatus, type A–1, the method of supplying oxygen and purifying exhaled air is performed by a canister containing a chemical compound which absorbs the carbon dioxide and water vapor in the exhaled air, the chemical reaction resulting in the evolution of oxygen.

c. Course of Air.

(1) The course the air takes within the type A–1 is as follows:

(a) Air is exhaled from the lungs.

(b) The exhaled air flows down through the exhalation tube (1 of the 2 breathing tubes) to the canister of chemicals where it is led through a central pipe to the bottom of the canister (fig. 71).

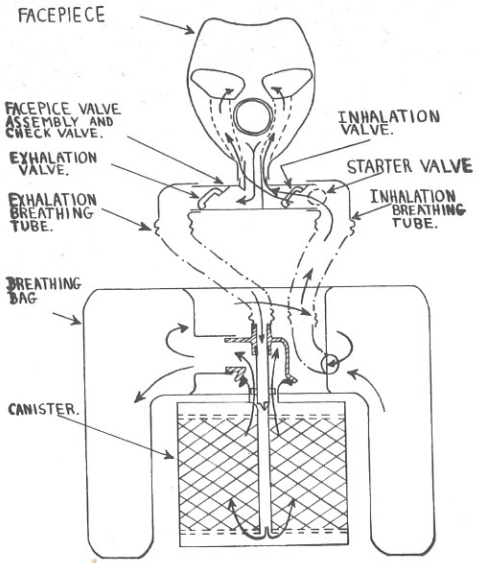

Figure 71.

(c) The air then rises through the chemicals in the canister, losing carbon dioxide, and gathering oxygen as it does so.

(d) The air from the canister flows into the single-section breathing bag and then through the inhalation tube to the lungs. The breathing bag serves to delay the return of the purified air to the lungs, and thus gives it time to cool by radiation.

d. Care and Removal of Canisters.

(1) The chemical in the canister will begin to deteriorate when air is admitted. Air will gain admittance through rupture of the inner seal in the neck of the canister, small holes in body of canister due to corrosion, leaky seams, etc. Consequently canisters should be stowed horizontally in dry spaces and care taken to insure that the protective seal in the neck of the canister is intact before the canister is installed in the apparatus. The chemical in the canister is protected by a tear-off cap and metal and cardboard disks over each neck. Therefore, if the tear-off caps are broken or torn, the canister should be used within a few days for training.

(2) The design of the type A–1 canister and the volume of the chemical are such that if used shortly after the seal is broken, sufficient oxygen will be supplied under moderately hard-working conditions for 45 minutes. While at the end of this period there is always residual oxygen in the chemicals, the resistance to air flow has progressively increased to the stage where breathing may become difficult. At the end of this time, a new canister should be inserted. These renewals may be repeated indefinitely.

e. Timing Device.

(1) In order that the wearer of the type A–1 oxygen breathing apparatus may be able to tell how much effective time is left in the canister, a timing device is placed in a position where he can see its dial at a glance. The dial is calibrated in minutes, in order that timer may be set for any fraction of an hour. The setting must be in excess of 10 minutes to provide sufficient spring tension to ring the bell. The timer bell will ring as a warning when the time set has expired. Canisters give best results when they are used continuously or with inactive intervals of only a few minutes duration.

(2) When the warning bell rings (or before if breathing becomes difficult), the wearer of the type A–1 breathing apparatus must go at once to the fresh air. When the canister is replaced with a new canister, the initial procedure of inflating the apparatus, exercising, deflating apparatus, etc. must be repeated until the canister becomes warm.

f. Markings on Canisters.

(1) The instructions for using canisters are stenciled on the newer canister in yellow paint (fig. 72).

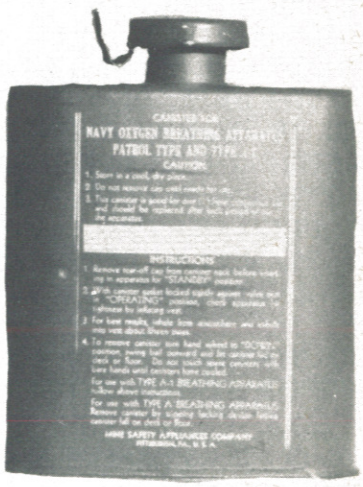

Figure 72.

These latter canisters contain copper screens and a copper liner. Canisters of the older issues contained steel screens and no liner. Also, the chemicals in the new canisters are of a slightly different granular size than that in the canisters of the previous issues. The copper screens and liners prevent any localization of excess heat in the canisters in cases where foreign matter accidentally introduced might otherwise cause ignition of the canister. The old type canisters should not be used. They should be disposed of in the same manner as used canisters.

g. Removing and Disposing of Canisters.

(1) To remove a spent canister, spread the legs apart; lean the upper part of the body with the apparatus slightly forward; turn the handwheel on the bail counterclockwise all the way down; with a quick forward motion, swing the bail outward. The canister will drop out. (Precaution must be taken to handle the canister only with suitable protection on the hands, since it will be very hot.)

(2) Do not allow any liquid to enter the opening of the canister, and do not hold the face over the canister opening. Oxygen in contact with oil is explosive. Because of the high oxygen content and the high temperature of the chemical in the canister, they will cause combustion of flammable material on contact, especially if such material is moist.

EXPENDED OR DAMAGED CANISTER SHOULD BE PUNCTURED IN SEVERAL PLACES IN THE BOTTOM AND THROWN OVER THE STERN OF THE SHIP AS SOON AFTER USE AS PRACTICABLE. THIS DISPOSAL SHOULD NOT BE MADE, HOWEVER, IF ANY OIL OR GASOLINE IS EVIDENT ON THE SURFACE OF THE SURROUNDING WATER, INASMUCH AS A CANISTER DROPPED INTO WATER SO CONTAMINATED MAY EXPLODE AND THE HEAT OF EXPLOSION MAY BE SUFFICIENT TO IGNITE THE OIL OR GASOLINE. CANISTERS ASHORE MAY BE DISPOSED OF BY OPENING AS NOTED ABOVE (ALL CANISTERS WILL BE FREE OF TEAR OFF CAPS AND SEAL PUNCTURED), AND BY THROWING THEM IN A DRUM PARTLY FILLED WITH OIL-FREE WATER. AFTER DISPOSING OF CANISTERS IN THIS MANNER, THE WATER WILL BE CAUSTIC. IT WILL CAUSE BURNS IN CONTACT WITH THE SKIN; THEREFORE, CARE SHOULD BE EXERCISED IN DISPOSING OF THE WATER AND EXPENDED CANISTER.

h. To use the Type A–1 Oxygen Breathing Apparatus.

(1) Before donning the apparatus, straighten all harness straps. One shoulder strap should be snapped on to the breast plate.

(2) With one hand, grasp the apparatus by the central casting between the sections of the breathing bag and immediately below the timer or by the breast plate. With the other hand, grasp the harness straps and put the head through the opening made by the crossing of the straps. Then slide one arm through the loop made by the shoulder strap which is fastened to the breast plate.

(3) Continue to hold the apparatus by the central castings or breast plate with one hand, and with the other, reach around to the rear and grasp the free end of the harness strap that passes over the shoulder on the opposite side. Bring this end under the armpit and snap it into the ring on one of the top corners of the breast plate.

(4) If necessary, adjust the height of the apparatus on the body by means of the metal slides on the harness straps. The height should be such that when the face piece is put on, the breathing tubes will have enough play in them to permit free movement of the head, and the timer dial will be at a satisfactory distance from the eyes.

(5) Attach the waist-strap ends to the small rings at the bottom corners of the body plate, and adjust it to hold the apparatus snugly against the body.

(6) Remove the metal tear-off cap from the top of canister by pulling the metal tab across the cap (fig. 73) and then pulling off the cap. Brush off the 2 cardboard and 1 tin disk. They are used to protect the metallic foil seal and have a tendency to stick to the rubber gasket. The removal of the cap and disks will reveal the metal-foil seal below and expose the rubber gasket. The canister is now ready but the seal for the moment is unbroken. On the apparatus, turn the hand wheel counterclockwise to down

position. The wheel is used to turn a screw through a supporting bail, or yoke for the purpose of pushing the canister into place in the canister guard and holding it there. With the screw turned down completely to clear the bottom of the canister guard, pull the bail forward until an unobstructed passage is made for the insertion of the canister. With the free hand, grasp the canister by the bottom and, keeping the bulged side out, push it as far as it will go into the canister guard. It will be stopped just short of making contact at the top of the chamber by a "canister stop" which is on the upper left side of chamber and will be released later by hand. Swing the bail back into place and lock the canister firmly, but not too tightly into

Figure 73.

the chamber by turning the hand wheel clockwise. The apparatus is now ready for standby service; the wearer still breathes outside air as the facepiece is not being worn at the time.

(7) To put the breathing apparatus into actual service operation, relieve pressure on the canister by turning the hand wheel counterclockwise just enough to permit ordinary hand pressure to release the canister stop, and thus clear the way to the top of the chamber. Turn the hand wheel clockwise until a tight contact is made with the canister top against the recess in the plunger housing, where the gasket assures a leak-proof seal. It is at this time that the metal foil seal is punctured.

(8) Adjust the straps of the facepiece to an approximate fit. Pull out the headband straps, especially the lower, or cheek straps, so that the ends are 1 inch from buckles; blow out the dust; clear your mouth of all objects; place headbands behind head then pull facepiece out, down and seat on face. To get a firm and comfortable fit against the face at all points, adjust the headband as follows: (a) See that the straps lie flat against the head; (b) tighten the lower, or neck straps; (c) tighten the side straps, but do not touch the forehead straps; (d) place both hands on the headband pad and push it toward the neck; (e) repeat operations (b) and (c); (f) tighten the forehead straps; (g) test for tightness of the facepiece in accordance with step (i) below. (With the facepiece in position, the wearer is cut off from the outside air, and he has only the air in his lungs. He must draw more air into the apparatus at once through the starter valve.)

(9) Pinch both breathing tubes tightly, and inhale. If the facepiece collapses, it is airtight. If it does not, further adjustment is necessary.

(10) Set timer, inflate breathing bags, and start the chemical reaction in the canister.

(11) When the warning timer bell rings indicating that the time is up, return immediately to fresh air.

i. Starting Type A–1 Canisters.

(1) Present canisters contain layers of chemical. The upper layers are the mixed oxides of sodium and potassium (MOX) while the lower layer is potassium super oxide (KOX) which is used for its faster starting qualities. Procurements made after January 1951 will contain only potassium super oxide (KOX). The chemical reaction in the canisters is caused by the moisture and carbon dioxide in the exhaled breath. The amount of moisture and carbon dioxide in the exhaled breath is proportional to the amount of work being done or performed within the previous few minutes. A man who has been performing some manner of work, such as walking rapidly, running, climbing ladders, just prior to donning an appartus, will be able to start oxygen evolution from the chemical in a relatively short period of time. On the other hand a man who has been standing or sitting still would require a longer period to start the chemical reaction. The starting instructions listed below are applicable only to canisters which have

been stowed in temperatures of 50° F. or above. For colder temperatures see cold starting procedures.

(2) After the facepiece has been adjusted and checked for an airtight fit, set the timer for 30 minutes if you are going to be performing hard work or 45 minutes if it will be light work, then start the chemical reaction in the canister by the following method:

(a) Grasp both breathing tubes with one hand, squeeze tightly, depress starter valve, and inhale deeply, release starter valve and tubes and then exhale into apparatus.

(b) Repeat this procedure until breathing bags are fully inflated (usually 3 or 4 breaths).

(c) Depress the starter valve and deflate breathing bags by pressing on them with forearms.

(d) Repeat (a), (b), and (c) until bottom of canister feels warm, then inflate breathing bags and proceed with work to be done.

(3) Cold starting procedure—As stowage temperature or the ambient temperature in which the apparatus is used decreases below 50° F., more and more effort is required to start oxygen evolution properly from the chemical due to condensation and possible freezing of the moisture in the exhaled breath on the walls of the breathing tube. The following instructions apply only to canisters stowed or chilled to temperature below 50° F. immediately before starting.

(4) Repeat (a) through (c) until bottom and top of canister are warm, then inflate breathing bag and proceed with work to be done. Excess time for filling bag and rapid deflation after filling is indicative of leakage. Do not use apparatus, but make complete check for leaks.

CAUTION: Always inflate bag by above procedure before using the apparatus since such procedure is absolutely necessary to start action of the chemical. Start of chemical action will be indicated by canister becoming warm.

j. To Clean Type A–1 Oxygen Breathing Apparatus.

(1) Some facepieces of these apparatuses have been made of synthetic rubber. Most disinfectants have a damaging effect on this material and also on the plastic lenses of the facepiece. In addition, such solutions if accidentally introduced in the canister through the breathing tubes or otherwise, will cause a violent reaction of the chemical. Therefore, the facepiece and any other part of the apparatus should be cleaned only with a mild soap and preferably warm water. When cleaning the facepiece and breathing tubes, the canister should be removed from the apparatus and replaced only after the parts mentioned are thoroughly dried.

(2) CAUTION: It has been found that the mica disk in the facepiece exhalation valve will stick to the valve seat, when saliva has not been cleaned out of the facepiece after use. It is absolutely necessary to wash these valves very thoroughly and dry them completely after every period of use. This can easily be done without disassembling the facepiece.

(3) SOAP AND WATER ONLY ARE TO BE USED IN CLEANING THE FACE MASK. DO NOT USE ALCOHOL. ALCOHOL FUMES WILL LIE IN THE LOWER PART OF THE SET AND CAUSE A DANGEROUS GAS TO FORM WHEN THE CANISTER IS PUNCTURED. DO NOT GREASE OR OIL ANY PART OF THE APPARATUS.

(4) INFORMATION: At the present time, the Bureau of Ships is drawing up specifications for a new type buckle and rubber headband straps to equip the present equipment (new procurement will be so equipped) with an improved headharness to facilitate ease in adjustment when donning a facepiece, and to provide a firm and comfortable fit. A kit will be available in the near future to convert the present apparatus.

Reference: Bureau of Ships Manual, chapter 93, Fire Fighting, Ship (NAVSHIPS 250–000–93).

7. All-Service Gas Mask (Mines Safety Appliance)

a. Description.

(1) The all-service gas mask (figs. 74 and 75) gives protection against all industrial gases including carbon monoxide. It is provided with a face piece of Kops type. Air enters through a check valve in the bottom of the canister and leaves at the top through a "timer" which records the amount of usage. The timer consists of a light metal disc over the opening of the

canister which is lifted with each inhalation. This movement actuates a system of gears which causes the hand on the dial of the timer to slowly rotate in a clockwise direction. It takes about two hours for this hand to make a complete revolution.

(2) Air is conducted from the timer to the facepiece through a rubber tube, corrugated to increase flexibility and prevent collapse.

(3) The inhaled dry air enter the facepiece through two tubes called deflector tubes that discharge over the eyeglasses, which prevents fogging.

(4) The exhaled air passes out of the facepiece through an exhalation valve.

(5) The all-service gas mask canister is painted red and is labeled "All-Service Canister." The canister contains various granular absorbents arranged in layers from top to bottom.

(6) Metal screen separators are placed between the layers. A spring at the top presses the materials firmly in place. Poisonous gases, vapors or smoke are removed or eliminated from the air passing through the canister.

(7) The canister DOES NOT GENERATE OXYGEN, but filters smoke and many of the gases out as it passes through the canister.

Therefore, the all-service gas mask should NOT be used in an atmosphere containing less than 16 percent of oxygen. As a precautionary measure, these masks are NOT to be worn below the ground level, a self-contained oxygen

Figure 74.

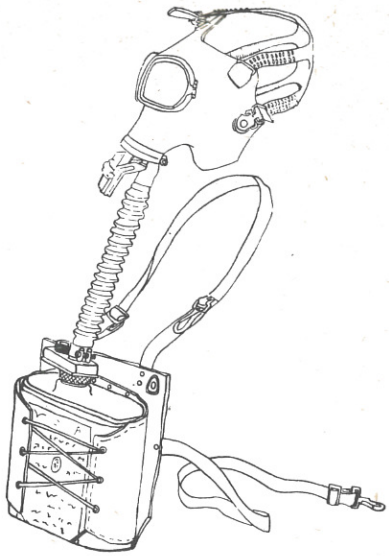

Figure 75.

or compressed air breathing apparatus should be used in any emergency below the ground level or in any operation where this element of doubt exists. In such cases, the oxygen or compressed air breathing apparatus should be used.

(8) The all-service mask is approved for respiratory protection in air containing acid gases, organic vapors or carbon monoxide not exceeding 2 percent by volume; ammonia not exceeding 3 percent, and in smokes, dust, and mists not exceeding 2 percent of total poisonous gases when more than 1 class is present.

(9) Weight of entire mask is approximately 5¼ pounds.

(10) The case should be carried in an upright position whenever possible.

(11) The entire gas mask must be inspected monthly.

(12) Check harness for tears; see that tape is on bottom of canister; check headbands for elasticity; check eyeglasses and timer glass for breaks; check corrugated tube and facepiece for holes; check timer glass connection, timer coupling to canister and exhalation valve guard for looseness; check exhalation valve for tears or being stuck closed, and mask for airtightness.

(13) A record must be kept on a chart which is attached to inside lid of case. The "time left" column should be observed before applying and using mask.

b. Operations for Changing Canister:

(1) Remove mask from case.

(2) Remove tape from bottom of canister.

CAUTION: See that all connections are tight before wearing.

(3) Suspend the mask on the chest by means of the neck strap.

(4) Tighten the body strap so that the canister is drawn snugly against the chest.

(5) Grip the facepiece where the headstraps are connected, insert the chin well into the lower part of facepiece, and pull the headstraps over back of the head.

(6) Tighten neckbands first, sidebands next, and front bands last.

(7) Place the palm of the hand tightly over the opening in the bottom of the canister so as to completely seal the opening.

(8) Inhale deeply. CAUTION: If facepiece does not collapse, investigate source of leakage. NOTE: This test *must* be made every time mask is used.

(9) For safety of wearer, canisters must be changed as follows:

(a) After 2 hours' use.

(b) One year after red tape is removed.

(c) If breathing becomes noticeably difficult.

(d) If fumes are noticed coming through canister.

c. Operations.

(1) Disconnect coupling at top of canister.

(2) Remove canister from holder.

(3) Remove rubber protector cap from top of new canister.

CAUTION: That when the canister is installed in an all-service gas mask, the red tape will not be removed until occasion to use the mask in actual service arises. When tape is removed, date will be noted on canister and time chart of time used, the canister will be resealed with adhesive tape and such canister will be replaced a year from that date, unless the period of time left has been consumed.

(4) Place new canister in holder.

(5) Check gasket on coupling and connect to canister hand tight.

(6) Remove timer cap.

(7) Loosen nut which holds hand on timer dial.

(8) With small object, move hand to zero position and tighten nut snug.

(9) Replace timer cap finger tight.

(10) Make record on chart and canister (fig. 76).

Figure 76.

8. Life Line

a. The Navy provides steel-wire lifelines for the firefighter. It is a 50-foot length of 3/16 inch, 7 by 9 aircraft cable, equipped at each end with a stout hook that is closed with a snap catch. The line has a maximum of pliability and it will slide freely around obstructions.

b. The uses of the lifeline are manifold; and while most of them are precautionary, rescue is often effected with the lifeline as a means of hauling an injured person to safety. Fire fighters who wear the type A, type A–1, type A–2, or oxygen cylinder type breathing apparatus and enter hazardous enclosures, have if necessary, a lifeline snapped onto the ring provided for this purpose in the harness of the apparatus. Similarly, all fire fighters who undertake tasks involving more than ordinary risks have a lifeline for emergencies. The line is manned by a fellow fire fighter who stands by ready to haul away on signal or when he believes his charge is in trouble. He must be careful to prevent snagging of the line, by paying it off the coil in his hand as the line is ex-

tended. For hauling a stricken person to safety and for lowering a rescue party into a compartment, and for various other uses, the steel wire lifeline is indispensable.

c. One important precaution in the use of the lifeline is obvious, but it is set down here because in the excitement of a fire it may be forgotten. It is this: A stricken person must never be hauled up by a lifeline that is attached to his waist. He may be dragged along a deck a short distance, but his weight must never be suspended on a line attached to his waist. If he is not wearing any sort of harness, the line must be made fast so that it passes under his arms and meets either at the front or the back. The tender should wear gloves and try to keep the line in contact with grounded metal, and away from electrical equipment.

9. Signal Cord

a. In addition to lifelines, signal cords are provided for use in connection with breathing apparatus. The signal cord is manned by a fellow fire fighter who stands by ready to assist in directing the man out or when he believes his charge is in trouble. The standard signals are set forth in the discussion on Breathing Apparatus.

b. The signal cord is not to be confused with a lifeline, which is not intended for rescue or lowering or hoisting, but rather to afford protection by a means of communication with the wearer of breathing apparatus. Under conditions where the lifeline can be used for relaying signals it is not necessary to use the signal cord also. If, however, a man is being lowered into a pit or hold by means of the lifeline, it is obvious that the signal cord would also be required for communicating signals.

0308. BASIC ALLOWANCE LIST

NOTE.—Replacement of existing appliances with others of newer design, lighter weight, etc. (as listed below) should not be authorized until present equipment becomes unserviceable.

1. ENGINE COMPANY EQUIPMENT

*1— 24′ extension or 35′—3 section metal ladder.
1— 14′ roof ladder.
1— hose roller.
1— sledge hammer (8 lbs.).
1— hammerhead chisel (long handle).
1— 12′ plaster hook.
1— 10′ pike pole.
2½″ hose (sufficient for load and change).
1½″ hose (sufficient for load and change).
2— 10′ hard rubber suction hose.
1— 3½″ soft suction hose 16′.
1— 200 ft., 1″ booster hose in 50′ sections (bar-way type couplings).
3— 2½″ nozzles—straight stream—adjustable fog combination 0° to 180° (type that allows selection of stream prior to opening).
2— 1½″ nozzles (same type as above).
1— booster hose nozzle (same type as above).
1— 1½″ applicator 10′.
*1— mechanical foam nozzle (1½″ NPU) and mechanical foam liquid.
*1— distributor nozzle.
*1— deluge set.
1— 2½ gal. water pump tank (shoulder strap—10′ hose with adjustable nozzle).
1— 15 lb. CO_2 extinguisher.
1— 20 lb. dry chemical extinguisher.
1— suction hose strainer.
2— axes, pickhead type (6 lbs.).
2— electric hand lanterns (standard permissible).
14— light alloy spanners (1 assigned per man).
14— light alloy—nylon cord hose straps (1 assigned per man).
2— chock blocks.
1— rubber mallet.
1— 48″ crow bar.
1— 36″ lock breaker (claw tool Hayward type).
1— hose clamp. Lever push down type (light weight).
*2— OBA standard Navy breathing apparatus and spare canisters, or 2 self-contained oxygen or compressed air supply types.
2— all-service gas masks.
2— adjustable hydrant wrench.
1— multiple combination hydrant spanner.
1— 125′ manila rope (¾″ dia.).
*1— 4½″ or 5″ double female connection (long-handle swivel).
*1— 4½″ or 5″ to two 2½″ female siamese.
1— 4½″ to a 2½″ double female reducer (2½″ swivel).
1— 2½″ straight siamese.
1— 2½″ to 1½″ reducer.
3— 2½″ double female (both swivel).
1— 2½″ to 4½″ or 5″ increaser (double female).
3— 2½″ double males.
2— 2½″ x 1½″ x 1½″ gated wye.
*1— electric wire cutter & rubber gloves.
1— bolt cutter.

NOTE.—All 1½″ couplings and conections shall have Straight Iron Pipe Threads (SIPT) and 2½″, 3″, 3½″, 4½″ and 5″ shall have National Standard Threads (NST).

*Need determined by the District Fire Marshal. Equipment not listed above, if needed, must be justified to and/or recommended by the District Fire Marshal.

2. SALVAGE EQUIPMENT FOR ENGINE COMPANY

NOTE.—Not required if operating with Ladder Company.

2—12′ x 18′ salvage covers (rubberized preferred) 2 covers in reserve.
1—scoop shovel.
2—square pointed shovels (long handle).
6—suitable sprinkler heads.
1—sprinkler kit (suitable wrenches—tapered plugs, etc.).
2—sprinkler stoppers.
2—sponges.
2—chamois.
2—corn brooms.
12—"S" hooks.
1—rubbish carrier 5′ x 5′.

3. LADDER COMPANY EQUIPMENT.

A. Ladders.

1—50′ extension with ladder strap.
2—35′ extension with ladder strap.
1—24′ extension with ladder strap.
1—14′ extension with ladder strap and 6′ pike pole.
1—24′ straight with ladder strap.
1—20′ straight (with folding roof hooks).
1—16′ straight (with folding roof hooks).

B. Tools and Equipment.

2—axes, pickhead type (6 lb.).
2—axes, flathead type (6 lb.).
1—long handle hammerhead chisel.
2—48″ crowbars.
1—36″ lock breaker (claw tool Hayward type).
1—wall pick (hammer headed).
1—12 lb. sledge hammer.
2—pike poles (8′–12′).
2—plaster hooks (10′ and 12′).
1—bolt clipper 30′ x ⅜″.
1—2½ gal. water pump can (10′ hose-adjustable nozzle).
1—15 lb. CO_2.
1—30 lb. dry chemical.
2—standard permissible electrical hand lanterns.
*4—oxygen breathing apparatus (OBA) and spare canisters or 2 oxygen or compressed air supply types.
2—long handled pointed shovels.
2—four tine forks.
2—rubbish hooks (8′).
2—125′ manila rope ¾″ dia.
4—crate hooks (longshoreman type).
2—lifebelts (plain snap type preferred).
2—pairs of leather gloves for lifeline use.
*1—distributor nozzle.
*1—ladder pipe.
*1—pull-down hook and chain.
*1—portable light generating unit.
*1—portable cutting torch.
*1—50 lb. battering ram.
*1—tool box.
(a) hack saw.
(b) cross cut saw.
(c) Stillson and monkey wrenches.
(d) ball peen hammer, wedges and blocks.
(e) tin snips.
(f) brace and bits.
(g) gas and water shut-off.

*Need determined by District Fire Marshal.

NOTE.—Equipment not listed above, if needed, must be justified to and/or recommended by District Fire Marshal.

C. Salvage Equipment.

NOTE.—Equipment not listed below, if needed, must be justified to and/or recommended by District Fire Marshal.

6—12″ x 18′ salvage covers (rubberized preferred) 6 covers in reserve.
1—lathing hatchet.
1—claw hammer.
2—scoop shovels.
4—corn brooms.
2—swabs.
2—squeegees.
1—roll tar paper.
12—suitable sprinkler heads.
2—sponges.
2—chamois.
2—sacks sawdust.
1—kit assorted nails.
4—sprinkler stoppers.
36—"S" hooks.
1—sprinkler kit (suitable wrenches—tapered wood plugs, etc.).
*1—eductor.
2—rubbish carriers 5′ x 5′.
2—hall runners 6′ x 12′.
1—50′ x ¾″ garden hose equipped with adjustable nozzle and rubber adapter coupling.

*Need determined by District Fire Marshal.

Chapter 4

FIRE FIGHTING EQUIPMENT AND ITS USE (continued)

Hydrants—Hose—Nozzles

0401. HYDRANTS

1. Hydrants (types).

(a) Various types of fire hydrants are provided for fire department use. The type, size and spacing are determined by the requirement of the district they serve as set forth in the Bureau of Yards & Docks technical manual, TP–PU4.

(b) Throughout naval fire departments, a variety of types are found in respect to the sizes of outlets. Sizes found include twin 2½ inch, 4″ x two 2½″ and 4½″ x two 2½″, with the latter most predominant.

(c) Valves for controlling the flow of water vary according to the make and type of hydrant. Throughout areas where freezing weather is not encountered, generally each valve is independently operated, whereas, when freezing conditions exist one valve opens all hydrant outlets. The characteristic of this type is that the last turn of the stem opens a drip valve to drain the body of hydrant.

2. Hydrant (operation).

(a) The operation of all fire hydrants is practically the same, except some of the extremely older types, such as the Ludlow, which operates in a reverse direction.

(b) In all cases the opening and closing of hydrants must be done slowly to prevent chattering of valves or damage to water mains. In using fire hydrants for extinguishing operations, open hydrant fully.

(c) Each fire apparatus is equipped with the proper hydrant wrench or spanner to fit the particular size valve stem on the activity. Adjustable hydrant spanner should be carried, if hydrant stems vary in size (fig. 77).

3. Hydrant (care).

(a) Maintenance routine, should include an operating test, to determine if hydrant functions properly and also, to determine the volume the hydrant is capable of delivering. During the test any discrepancies detected should be immediately reported to the Public Works Department. The standard navy procedure in regard to testing fire hydrants involves a semi-annual test.

(b) Threads of the hydrant outlet and protector caps should be cleaned, oiled and gaskets inspected. Swivel chain on protector caps free

Figure 77.

turning and the hydrant painted according to navy regulation. (Fresh water No. 14 brilliant yellow, salt water, No. 14 brilliant yellow base, No. 13 fire red top, Reference Navy Standard Color Code Manual.)

(c) Special attention should be given to keeping the hydrant accessible and unobstructed at all times, all growth should be cleared sufficiently to provide full visibility.

0402. HOSE AND APPLIANCES

1. General Description and Use

a. Hose.

The following types, sizes and lengths of hose are in general use by naval fire departments:

3½″ Double jacket cotton, rubber lined 50′ sections, national standard thread (NST).

2½″ Double jacket cotton, rubber lined 50′ sections, national standard thread (NST).

1½″ Double jacket cotton, rubber lined 50′ sections, straight iron pipe thread (SIPT).

1″ Booster, rubber, 50′ lengths.

¾″ High pressure, rubber, 50′ lengths.

Garden hose, 50′ lengths.

b. Hose (care).

(1) Some makes of hose are antiseptically treated to prevent mildew or rot, however, continued dampness is injurious. (Proper care is important as replacement expense is very great.)

(2) Wet hose should not be allowed to remain on apparatus longer than necessary.

(3) When salt water has been used, flush thoroughly with fresh water and dry.

(4) Hose used at fires should be cleaned and dried in hose tower, on hose rack or in drying cabinets as soon as practicable; use a stiff brush or heavy broom with clear water to scrub hose.

(5) Hose carried on apparatus should be changed monthly to prevent damage to the lining, caused by sharp bends, dry rot, due to lack of air circulation.

(6) Booster hose on reels and in baskets, should be removed every 60 days, flushed, washed, and sections changed to a different position and replaced for service.

(7) The greatest wear and tear on hose comes at fires. This may be reduced to a minimum by care in handling. Hose lines should not be dragged unnecessarily over pavements. Needless traffic should be prohibited from passing over hose.

c. Hose (inspection).

(1) Prior to placing hose in storage, it should be visually inspected for cuts, cracks, blisters, tears, rips, oily matter or organic material.

(2) Couplings should be inspected for the following: defective threads, couplings out of round, female swivel to be checked for free working, also gaskets should be checked for size and condition; replaced when necessary. Dirt shall be cleaned from male and female threads with a wire brush.

(3) Couplings should not have oil or grease applied to them; if not free turning, they should be spun in a pail of soapy water, then thoroughly rinsed. Light dusting of female swivel with dry graphite will aid in maintaining a free working swivel.

(4) Following the inspection, hose should be properly rolled, and tagged, showing date of inspection and by whom inspected.

Figure 78.

d. Hose (records).

Hose records should be kept of all hose by inventory, showing the following data: Size, type, threads, date of purchase, manufacturer, serial number (serial number applied by each activity, and stamped on each male coupling), date of test and condition.

e. Hose (rolling, 2½-inch).

(1) The loading roll is to be used when rolling hose for storage in company quarters. Rolling removes the air and when coupled together permits faster loading (fig. 78).

(2) Lay each section out straight; carry male coupling towards female end of hose; lay

male coupling on hose approximately 4 feet from female coupling.

(3) Roll hose from folded end until couplings are reached. One man can guide top layer as hose is being rolled.

f. Hose (loading, 2½″).

(1) Carry roll of hose and lay on either side of compartment to be loaded, 3 feet from the rear running board, with female coupling pointing to rear and male toward apparatus with both couplings on side of roll farthest from compartment (fig. 78).

(2) Repeat operation until all hose for compartment to be changed is laid out in a suitable manner behind each other.

(3) Take female of first roll of hose, connect it to male coupling of second roll of hose and tighten coupling handtight. (Inspect for gaskets prior to coupling hose.)

(4) Continue to connect all female couplings to male couplings until amount of hose to be loaded is complete. The last female coupling to be capped if necessary.

(5) The hose to be changed will then be removed from the apparatus, hose compartment cleaned and change made with as much speed as is consistent with safety. Change in one compartment must be completed before other compartment is disturbed.

(6) Take male end of hose, place next to center partition of double compartment or, side of single compartment; allow male end to protrude the length of coupling threads beyond folds. Pass hose in alongside of compartment, around closed end and back along opposite side.

(7) Fold hose in even with open end of compartment; pass back around compartment in a reverse direction; when couplings interfere in making fold, or couplings come together, make a double fold, dutchman, at closed end of compartment.

(8) When layer is complete pass hose over top of layer in closed end of compartment, to one corner, bend this short portion over flat, pass hose along end and side of compartment; continue new layer in same manner as first layer.

(9) When compartment is loaded, connect female coupling from top of one compartment to male coupling at bottom of other compartment.

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g. Hose (loading, Wyed 1½-inch lines).

(1) On engine company apparatus, two 100-foot lines of 1½-inch hose are carried connected to a Wye assembly and loaded in a compartment parallel with the apparatus.

(2) Lay 4 sections of 1½-inch hose parallel behind 1½-inch hose compartment, female ends toward apparatus.

(3) Connect female couplings of two sections to male outlet of Wye reducer on holder (fig. 79).

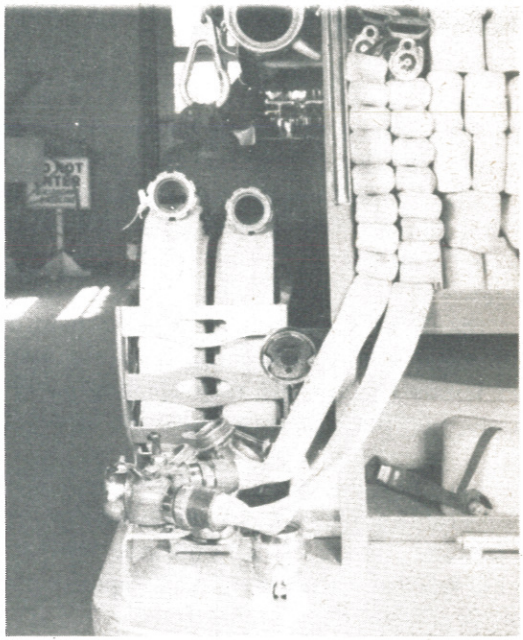

Figure 79.

(4) Pass both lines to closed end of compartment; extend lines horizontally to end of compartment, side by side.

(5) Continue horizontal folds until couplings reach outer end of compartment, connect other sections.

(6) Fold hose back of couplings; pass into compartment, making a horizontal fold.

(7) Continue horizontal folds until male couplings are reached; FIRST FOLD ABOVE CENTER COUPLINGS TO EXTEND APPROXIMATELY 10 INCHES BEYOND COUPLINGS (fig. 79b); balance of folds to extend one coupling length out of compartment.

(8) Connect nozzle to each line; SHUT NOZZLES OFF; place on top of hose just inside open end of compartment.

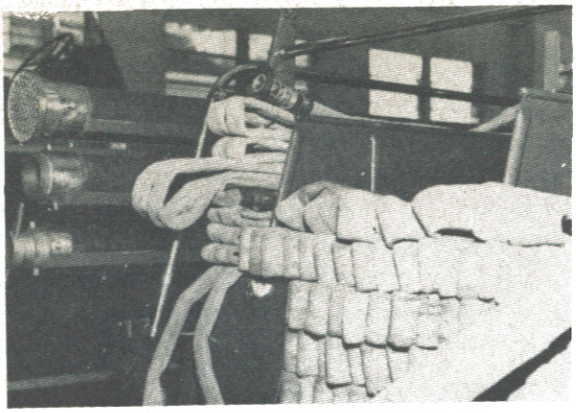

Figure 79b.

h. Hose Pack (1½-inch hose).

(1) Roll section of hose, using loading roll.

(2) Connect nozzle to male end; shut nozzle off, connect Wye reducer, 2½-inch to two, 1½-inch outlets to female end; cap unused outlet.

(3) Fold Wyed end of hose in about one-half the length of pack, capped opening up; insert nozzle tip into 2½-inch opening of Wye; handle up; place against object or knees (fig. 79c).

(4) Fold hose back and forth until half of hose is folded, turn balance of hose one half turn to outside. (Fig. 79d.) Continue folds until end is reached, turn last fold in opposite direction (fig. 79e).

Figure 79d.

(5) Fold half of folded hose on top of other half; allow single lap to extend around capped outlet of Wye.

(6) Place completed folds in center of harness: Nozzle to point downward (fig. 79f.) Secure straps.

i. Hose (connecting).

(1) Grasp male coupling with one hand; palm up; back of hand resting on knee.

Figure 79c.

Figure 79e.

(2) Grasp female coupling with other hand; hold hose between arm and body; make connection (fig. 80).

j. Hose (tightening couplings).

Tighten hose couplings and fittings hand-tight unless conditions make the use of a spanner necessary.

k. Hose (disconnecting couplings).

(1) To prevent delay, due to tightness, it is advisable to place the coupling on the ground, stand on the hose and use both hands to disconnect the coupling.

Figure 79f.

(2) Step on hose immediately behind male coupling (fig. 81).

(3) Use both hands to loosen and back off swivel of female coupling.

l. Hose (replacement of couplings).

(1) The coupling is attached to the hose by means of a brass expansion ring. The inside surface of the coupling shank is corrugated to increase the tension of the hose on the coupling. The hose is pressed into the corrugation of the coupling shank and held there by the expanded metal ring. Any chance for seepage into the joint is prevented by the soft rubber gasket between the end of the hose and shoulder of the coupling.

Figure 80.

(2) The end of the hose is trimmed square and is fitted into the tailpiece of the coupling with the gasket in position. The expansion ring has an outside diameter just slightly under that of the coupling waterway, and is, therefore, placed so that when expanded, it will have the same bore as the coupling. In placing the

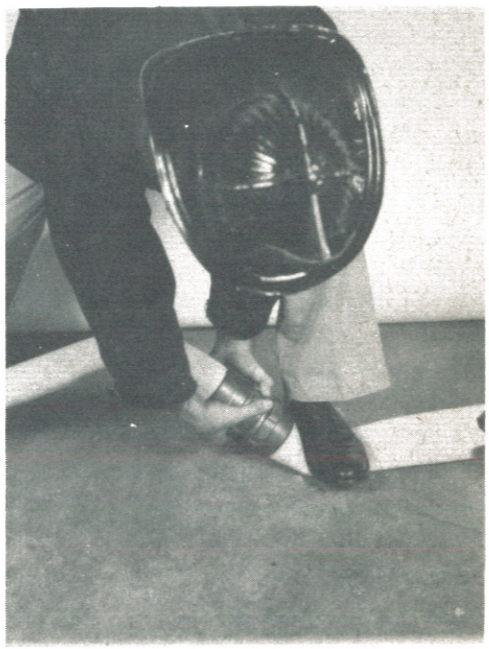

Figure 81.

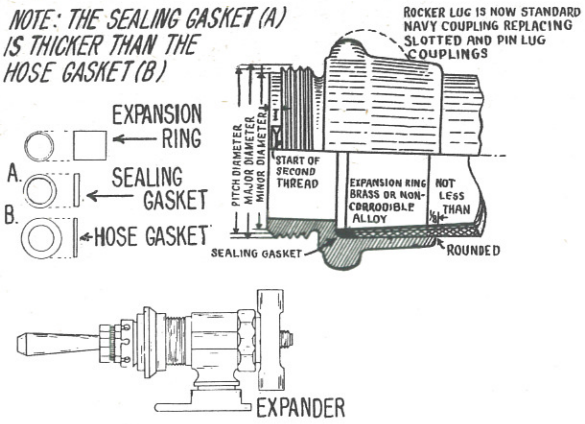

Figure 82.

expansion ring in position, it is centered in sealing gaskets (fig. 82).

(3) The expander is a special tool which may be inserted through the coupling to expand the expansion ring, when the expanding segments are correctly in position. Turning the handle of the expander, causes the ring to be expanded uniformly outward in circumference, considerable skill and experience is required to know just how much to expand the ring. Caution must be exercised so as not to cut the inner lining of the hose or cause the gasket to protrude into the waterway. All hose recoupled shall be immediately tested to the required pressure.

m. Hose Couplings and Hose Threads.

(1) *Couplings and threads on 2½-inch and 1½-inch cotton-jacketed, rubber-lined fire hose have been standardized for use ashore and afloat. Future procurements will provide the following type couplings and threads:*

(a) *2½-inch hose, Rocker-lug coupling, National Standard Thread (NST) (7½ threads per inch).*

(b) *1½-inch hose, Rocker-lug coupling, Straight Iron Pipe Thread (SIPT) (11½-inch threads per inch).*

(c) *Booster and high pressure rubber hose will be equipped with Bar-Way (or equal) couplings.* (NOTE: *When hose is damaged, these couplings can be easily removed and reused.*)

2. Testing Hose

(1) Regular fire pumpers are considered suitable for service testing of fire hose and are used for this purpose at most shore activities. A special pumping device (hand pump) is used in conducting acceptance tests on new hose, in which case higher hydrostatic pressures are required. An expedient method of periodically testing fire hose is accomplished by the following procedures:

(a) Using the fire apparatus (pumper), lay out all hose from one compartment of hose bed in a forward manner (several single lines consisting of two sections (100′) with female couplings close to hydrant and pump, as shown in figures 83 and 84.

(b) Reload the empty compartment on apparatus with reserve hose (as response to alarms can be made if necessary).

(c) Couple two lines to pumper which has been connected to hydrant.

(d) Fill hose with water, releasing air through shutoff nozzles. (While filling, the nozzle must be left open, raised 2 or 3 feet off the ground and held there until a solid stream is discharged without spurting or air spray, to permit all free air to escape. This is important for sake of safety.)

(e) Close nozzle, raise pressure to 200 pounds and hold five minutes during which time each section is examined for defects. Where a section of hose bursts, it will be necessary to remove the section, replace with another section and continue the test.

Figure 83.

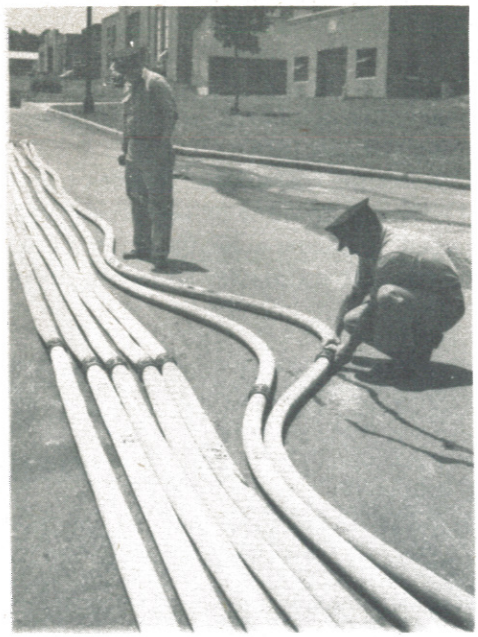

Figure 84.

CAUTION

When using the fire apparatus (pumper) for testing fire hose, the pump pressure should not exceed the maximum pressure as recommended by the Pump Manufacturer.

When using the pump for testing fire hose it becomes necessary to churn the water for a period of time, a drain should be opened on the discharge side of the pump to prevent the excessive heating of water within the pump due to friction.

(f) Repeat this procedure until all hose has been tested.

(g) In regular tests, which are made semi-annually of all hose in service, test pressures should not be much above 200 pounds per square inch, unless conditions of service require unusually high working pressures at fires. In that case the test should be about 50 pounds per square inch in excess of the working pressure needed.

3. Nozzles

a. General Description.

(1) Figure 85 shows the variety of hand line nozzles employed throughout naval fire departments.

(2) Typical solid stream and fog nozzles in general use range in the following sizes.

Butts	*Tips*	*Stream*
2½ inch	Adjustable	Straight-fog
2½ inch	1 inch, 1⅛ inch, 1¼ inch	Straight
1½ inch	⅝ inch (all purpose)	Straight-fog
1 inch	¼ inch (booster)	Straight-fog
Applicator	Low velocity	Fog

b. Nozzles (straight stream).

Under conditions requiring a fire stream of great reach, penetration and volume, the straight stream nozzle is commonly used.

c. Nozzles (fog).

Under conditions requiring minimum electrical conductivity, minimum water damage, maximum protection against radiated heat, maximum absorption of toxic gases and vapors, or application to flammable liquids as well as structural fires, fog nozzles in sizes discharging from a few GPM to over 700 GPM, are of great value.

d. Nozzles (Combination straight stream and adjustable fog).

Probably the greatest advancement in nozzles at the present time has been the development of a combination straight stream and adjustable fog nozzle having an independent and integral shut off device which permits pre-setting the nozzle for straight stream or any desired angle of fog spray prior to discharging any water from loaded line.

e. Connecting Nozzle.

(1) Grasp coupling with one hand, palm up; rest back of hand on knee.

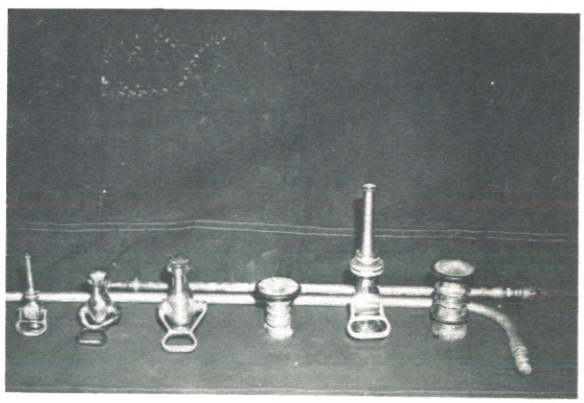

Figure 85.

(2) Grasp tip of nozzle with free hand; connect to coupling held in other hand (fig. 86).

(3) (Shut off nozzle.)

f. Connecting Cellar Nozzles.

Figure 86.

(1) When operating cellar nozzles the stream should be directed upward at an angle to obtain the maximum range, however, care must be exercised that the stream is not directed at such an angle as to strike beams or other obstructions which would destroy its effectiveness. Continual movement is essential to insure the greatest effect being obtained (fig. 87b).

(2) Connect cellar nozzle to charged line (shutoff should be used at this point).

(3) Adjust cross bar.

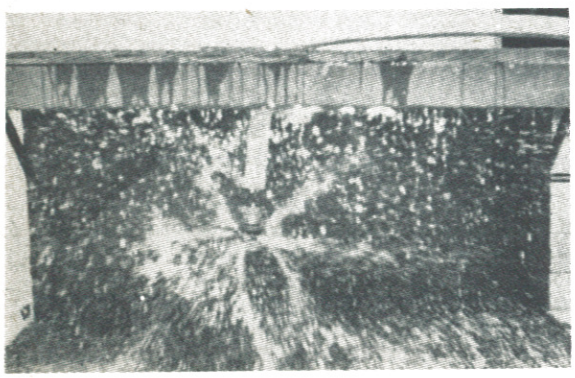

Figure 87.

(4) Cut hole (approximately 1 foot square for placing nozzle in operation).

(5) Insert vertical portion of nozzle into hole, open shutoff; direct stream by means of control handle (fig. 87b).

g. Connecting Distributor Nozzles.

(1) The distributor of the revolving type is designed to throw a heavy spray of water over an area approximately 30 feet in diameter (figs. 87 and 88).

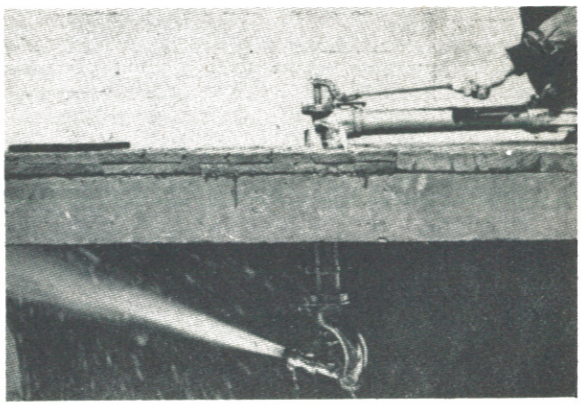

Figure 87b.

(2) These distributors are usually placed in operation by lowering through opening to the floor or deck below, then withdraw halfway. (When used for pier operation lower 5 feet.)

(3) A short section of hose, approximately 10 feet in length, should be used between shutoff and distributor, this allows the shutoff nozzle to remain on deck.

(4) Connect to 10-foot section and lower through hole (a hole approximately 1 foot square).

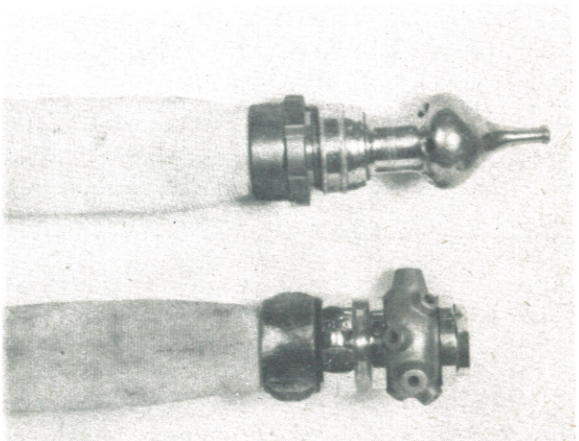

Figure 88.

h. Connecting Boring Nozzle.

(1) The boring nozzle of the revolving type is designed to work or worm itself into deep seated fires, such as found in coal piles or bunkers, sawdust piles, hay stacks, etc. (Fig. 88).

(2) These boring nozzles will work their way into deeply seated fires by means of a revolving motion to free obstructions and allow the back pressure of the rear discharge orifices to produce the drawing power.

(3) The discharge will flood and wet down the heated material as encountered.

(4) Use a fifty-foot section of 2½-inch hose on boring nozzle, this allows shutoff which controls same to be available for ready use on exterior of material involved.

i. Connecting to Deluge Sets.

(1) Deluge sets of different types are used in locations not accessible to wagon batteries or water towers, to deliver powerful streams a considerable distance, or where the extent of a fire necessitates the use of a large volume of water.

(2) The deluge sets are usually provided with threeway manifolds, equipped with clapper valves.

(3) Nozzle tips generally range in size from 1½ inches to 2 inches.

(4) Not less than two 2½-inch lines, or their equivalent, should be connected to the intake manifold to supply sufficient volume for an effective stream.

(5) Control of the water is provided by nozzle shutoffs connected to the supply lines.

(6) Due to the reactionary force created by the large stream, supply lines are connected in from stream side to counteract back pressure (fig. 89).

(7) Direct stream as desired (large streams should be manipulated intermittently to give full effectiveness).

(8) Same procedure can be followed when using wagon batteries, water towers and ladder pipes (exception; back pressure is counteracted by the fire apparatus).

j. Connecting to Chemical Foam Generator.

(1) The foam generator is a portable device for producing large quantities of fire foam for use on oil fires where permanent installations are not provided, or other similar fires where gasoline or flammable oils are present in large quantities (fig. 90).

(2) Operation of the generator consists of feeding foam powder into a hopper and forcing water under pressure from the hydrant or pumper, through an injector type device which draws the powder and mixes it with water producing foam as desired.

(3) Foam powder is a finely ground material supplied in sealed cans containing approximately 50 pounds.

Figure 89.

(4) One pound of powder will make about 8 gallons of foam and with the generator operating at 100 pounds pressure, about 2 cans of powder a minute will be consumed.

(5) The hopper should be kept well filled with powder during the entire period of operation.

(6) Cold water makes a better foam than warm water, and salt water is considered equally effective as fresh water.

(7) The length of the line supplying the generator is immaterial so long as it provides sufficient pressure at the generator, preferably 75 to 100 pounds.

(8) Two or at most 3 fifty-foot sections of 2½-inch hose are used on the discharge side of the generator; if warm water is used not over two 50 foot sections should be attached.

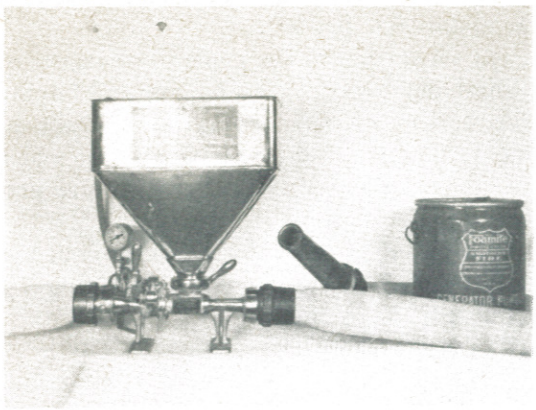

Figure 90.

(9) Shutoffs are not used in the discharge line and the line must be free from kinks to prevent restriction to discharge stream.

(10) A large tip, at least 1¾-inch, should be used on the discharge line.

(11) For best results on flammable liquid fires the foam should be played on the inside wall of the container just above the burning surface, to permit the natural spread of the foam back over the burning area. If this cannot be done the foam shold be applied in such a manner as to fall lightly on the burning surface. Submersion of the foam must be avoided if possible.

(12) Lay a 2½-inch line from source of water supply to a point about 100 feet from fire, windward side if possible; equip line with shutoff nozzle; remove tip and connect to intake side of generator.

(13) Locate generator at end of supply line; connect discharge line and equip with proper tip (fig. 90).

(14) Open shutoff on supply line; regulate generator pressure by means of control valve on generator.

(15) Fill hopper with foam powder, (water must be flowing before filling hopper); keep hopper filled during period of operation.

(16) Make frequent checks of pressure and continue to add powder as needed. The generator, discharge hose and nozzle must be flushed thoroughly after using.

k. Connecting to Mechanical Foam Nozzle.

(1) The mechanical foam nozzle (N. P. U.) is portable and consists of a 21-inch piece of flexible metal, or asbestos composition hose, 2-inch diameter, with a solid metal nozzle outlet and, in the butt end a suction chamber and an air port (impinging cage) the foam discharge is a mixture of water, liquid-foam solution, and air. The mechanical foam nozzle is used with a pickup tube attached to it, but the pickup tube can be removed if the liquid is introduced by other means (fig. 91).

(2) One gallon of liquid-foam solution will produce about 133 gallons of mechanical foam.

(3) The contents of 1 can of liquid (5 gallons) will last approximately 1½ minutes, and produce about 660 gallons of foam.

(4) Mechanical foam in comparison with chemical foam has definite desirable characteristics; it is free flowing and the operation for application is much faster.

(5) Connect the mechanical foam nozzle to a 1½-inch supply line.

(6) Turn on water at source of supply insert the metal pipe end of the pickup tube into a container of mechanical foam solution; push it to the bottom and hold it down firmly.

(7) When the container is nearly empty take out the pickup tube and insert it into another container.

l. Connecting Siphon or Ejector.

(1) The siphon or ejector is a device used to remove water from basements, manholes, flooded compartments, etc., and can be placed in operation where sufficient pressure is available (fig. 92).

(2) These appliances may be used in locations inaccessible to pumpers, or where the water is below effective drafting reach; (except in extreme emergencies, fire pumpers are not to be used for pumping out basements, manholes, etc.).

Figure 91.

(3) A 2½-inch hose line, connected to a source of supply having sufficient pressure, may be used to supply water for the operation of siphon or ejector.

(4) Efficiency of the siphon or ejector is governed largely by the pressure on the supply and by the size of the discharge hose.

(5) Different types are found throughout naval fire departments. Operating principles are basically the same.

(6) Connect supply line or lines (two lines may be siamesed).

(7) Connect discharge line (sizes vary and preferably a hard suction should be used).

(8) Lower assembly into position, place discharge line so water will drain to desired point.

(9) Start water flowing at desired pressure.

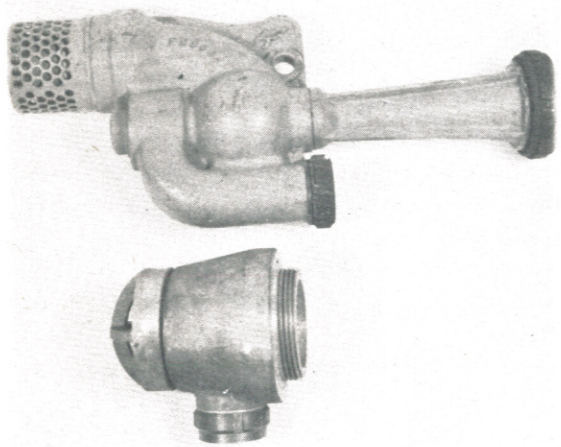

Figure 92.

4. Fittings (Hose)

a. General Description.

(1) Fittings of various types and sizes are used to facilitate assembly of the many hose combinations used in fire fighting operations.

(2) The following types are in general use throughout the naval fire departments, however, the fittings provided for any one fire department are determined by the need of that particular fire department.

b. Double Male.

(1) Double male fittings are provided with male connections on each end and are used to connect two female couplings (fig. 93), A, B, C.

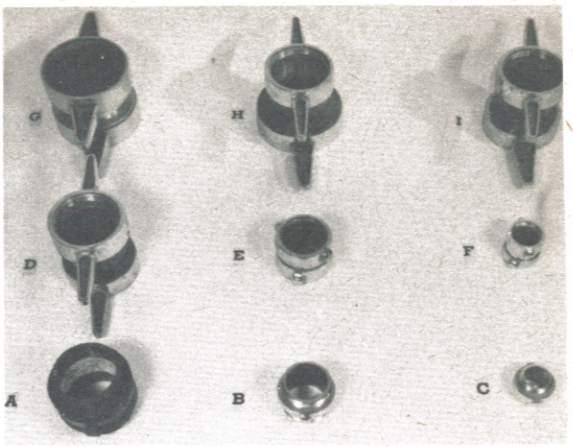

Figure 93.

(2) These fittings range in sizes of 3½", 2½" and 1½".

c. Double Female.

(1) Double female fittings are provided with female connections on each end and are used to connect two male couplings (fig. 93), D, E, F, G, H, I.

(2) These fittings range in sizes of 4½", 4", 3½", 2½" and 1½" or a combination of these sizes.

d. Increasers.

(1) Increasers are fittings provided with male and female threads, the male being the larger, and are used to connect a smaller line to a larger (fig. 94, A–B–C–D).

(2) These fittings range in sizes as follows: 4" x 4½"—2½" x 3½"—two, 2½" x 4½"—2½" x 4½".

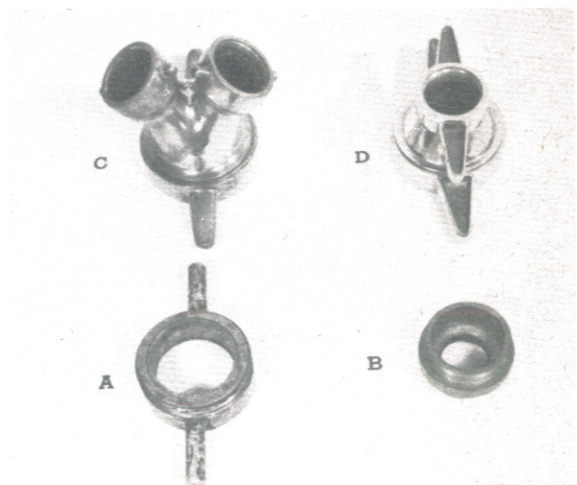

Figure 94.

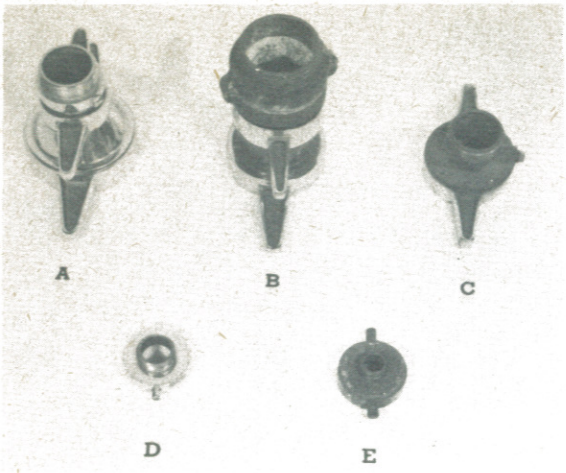

Figure 95.

e. Reducers.

(1) Straight reducers, are fittings provided with male and female threads, the female being the larger, and are used to connect a larger coupling to a smaller (fig. 95, A–B–C–D–E).

(2) These fittings range in sizes as follows: 4½″ x 2½″—4½″ x 3½″—4″ x 2½″—2½″ x 1½″—2½″ x 1″.

(1) Wye reducers are fittings having 1 female and 2 male connections, the female being the larger, and are used to reduce a larger line to 2 smaller lines (fig. 96, A–B–C).

(2) These fittings range in sizes as follows: 3½″ x two 2½″—2½″ x two 1½″—1½″ x two 1″.

f. Siamese (straight).

(1) Straight siamese fittings are used to connect hose lines of the same size and are as follows:

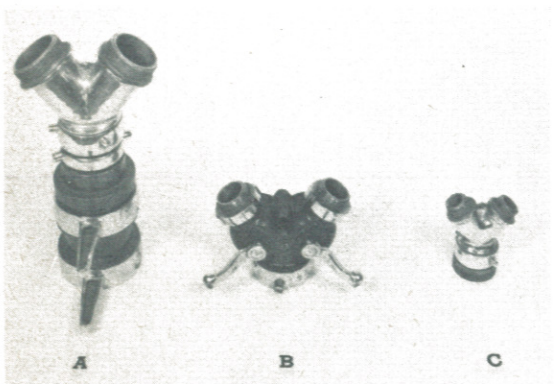

Figure 96.

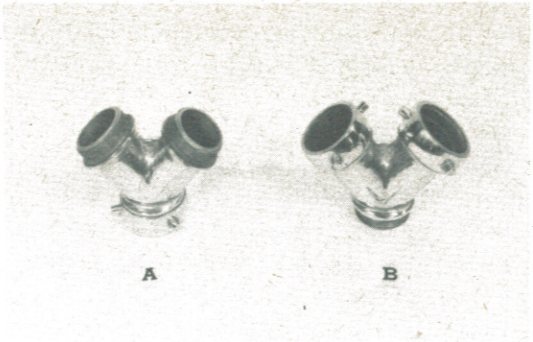

Figure 97.

(2) The straight siamese has 2 females and 1 male connection and is used to connect 2 supply lines into 1 discharge line (fig. 97, B).

g. "Y" Fitting (straight).

(1) The straight "Y" fittings are used to connect hose lines of the same size.

(2) Straight Y's have one female and two male connections and are used to connect one supply line into two discharge lines (fig. 97, A).

h. "Y" (gated).

(1) Gated "Y" fittings are used to connect hose lines of the same size, also, to smaller sizes. They are commonly used for extending one 2½ inch line into two 1½ inch lines.

(2) These fittings are of the two sizes: 2½″ x two 2½″ and 2½″ x two 1½″ (fig. 98, A and B).

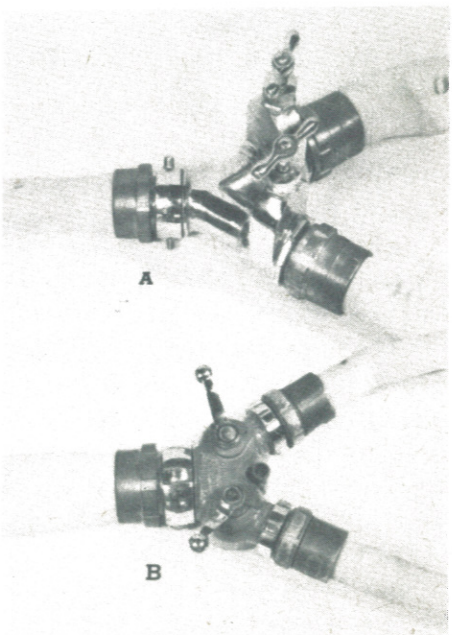

Figure 98.

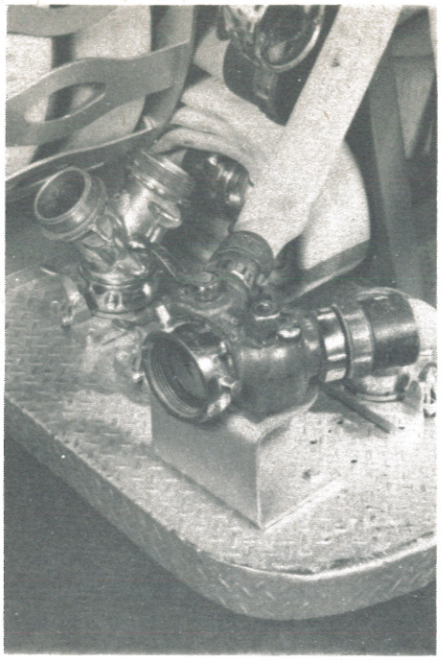

Figure 99.

i. Gated (assembly).

(1) This assembly is carried in a holder (either or both sides of the rear runningboard) on practically all structural fire apparatus.

(2) Two 1½-inch lines, each 100 feet in length, are carried connected to "Y" assembly (fig. 99).

5. Hose Combinations

a. General.

(1) To effectively carry on fire fighting operations it is sometimes necessary to EXTEND, REDUCE, INCREASE, SIAMESE, Y, or TAP-IN hose lines. Various combinations of hose, nozzles, and fittings are used for the purpose.

(2) Whenever practicable, all hose, nozzles and fittings should be connected and placed in position before interfering with the original working line; however, fittings without swivels should be connected to the original line before other lines are connected.

(3) Nozzle tips removed from original working lines should be set in an upright position where they will not become damaged or lost.

b. Extending.

(1) Obtain the required amount of hose for extension line; connect nozzle to male end; SHUT NOZZLE OFF.

(2) Place extension line in desired position with female coupling near the nozzle of working line.

(3) Shut off nozzle on working line; remove tip.

(4) Connect extension line to shutoff butt on working line; open shutoff (fig. 100).

(5) Open nozzle on extension line.

c. Reducing.

(1) Operations for reducing hose lines are the same as for extending except that the proper size reducer is used to connect the extension line to original working line.

d. Using Siamese and Wye Fittings.

(1) General.

(a) Two or more lines may be laid and siamesed into a single line, when necessary to reduce friction loss or when a larger volume of water is needed than can be supplied by a single line. Lines should be siamesed as near the fire as practicable.

(b) Single lines may be wyed into two or more lines of the same size or smaller, for use where heavy streams are not required.

(2) Two lines siamesed into one.

(a) Obtain required amount for single line; connect nozzle to male end; SHUT NOZZLE OFF: connect siamese to female end.

(b) Place line in position with siamese near nozzles of the original lines.

(c) Close nozzles on original lines; remove tips.

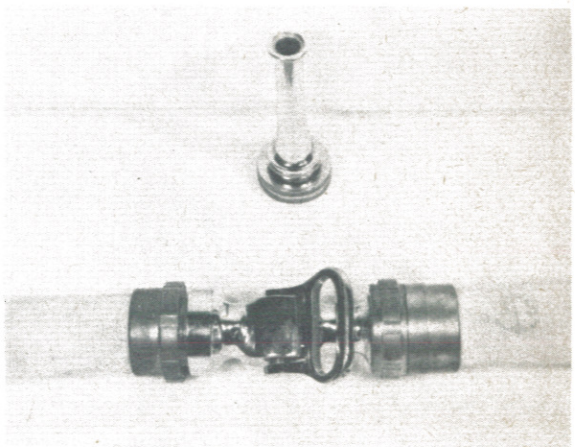

Figure 100.

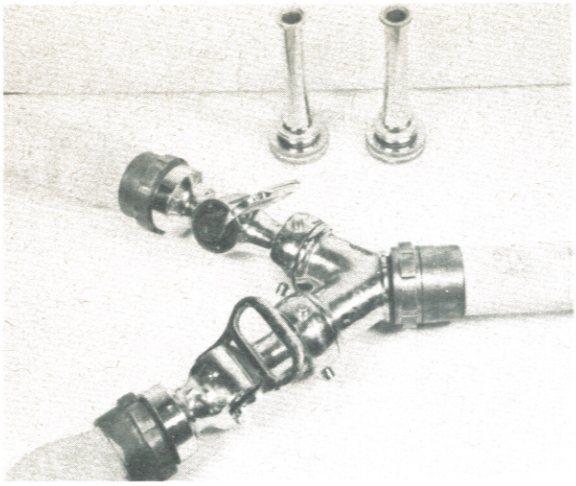

Figure 101.

(d) Connect siamese to shutoff butts of original lines; open shutoffs.

(e) Open nozzle on single line (fig. 101).

(3) One line wyed into two.

(a) Obtain required amount of hose for the two lines; connect nozzles to male end, SHUT NOZZLES OFF; connect wye to female ends.

(b) Place both lines in position with wye near nozzle of original line.

(c) Close nozzle on original line; remove tip.

(d) Connect wye to shutoff butt of original line; open shutoff.

(e) Open nozzles on both lines (fig. 102).

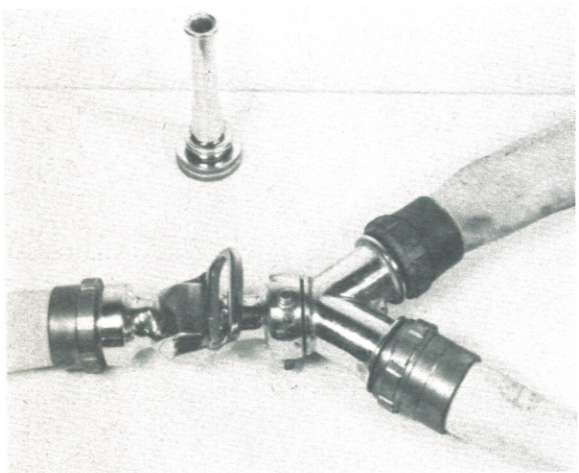

Figure 102.

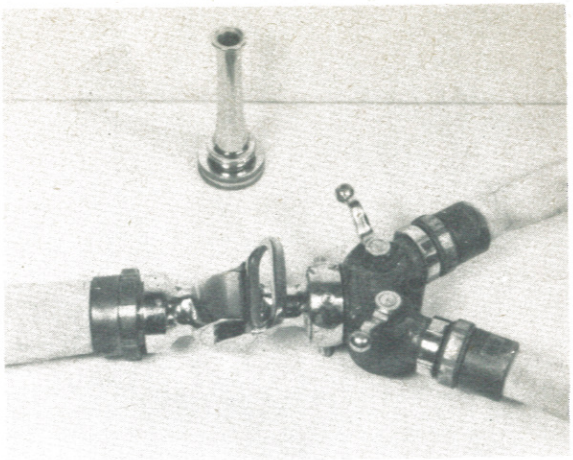

Figure 103.

(f) The operation for wyeing 1 line into 2 or more smaller lines is similar to wyeing 1 line into 2 except that suitable fittings are used to reduce and wye the lines (figs. 103 and 104).

e. Tapping-in.

(1) Tap-ins are placed in hose lines to provide an outlet for connecting additional lines with which to extinguish spot or other fires.

(2) The tap-in assembly consists of a wye with a shutoff butt connected to one of the male connections. This assembly is used whether the line is to or from the fire.

(3) Make up tap-in assembly; close shutoff; place assembly near connection in line where it is to be inserted.

(4) Shutoff flow of water, either at source, by means of a hose clamp or by kinking line.

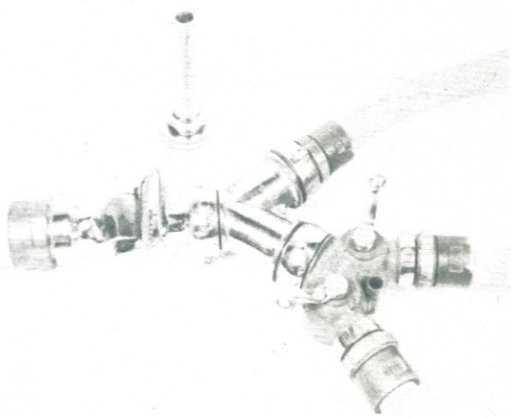

Figure 104.

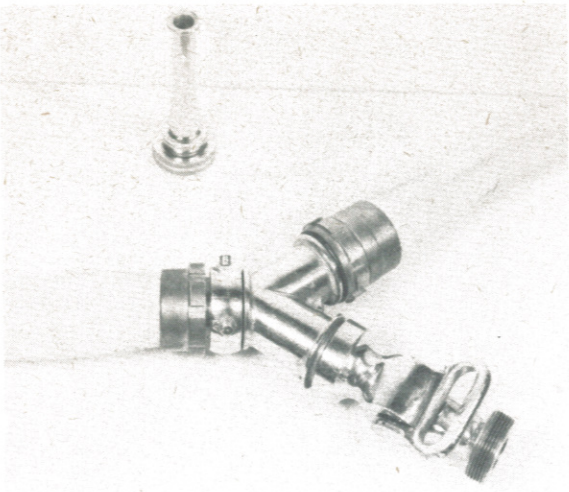

Figure 105.

(5) Disconnect coupling; insert tap-in assembly, recharge line (fig. 105).

6. Hose Handling

a. One Man Fold and Carry.

(1) When a section of 2½-inch hose is needed to extend line, etc., and a Hose Pack is not available, the ONE MAN FOLD, may be used to carry the hose.

(2) Extra hose is usually obtained from the apparatus.

(3) Grasp female coupling; run back until next coupling is clear of apparatus.

Figure 106.

(4) Carry female coupling and place on hose near center.

(5) Grasp female coupling and center of hose in one hand; carry both to one nozzle length beyond male coupling.

(6) Disconnect coupling; replace female end in bed.

(7) Connect nozzle to male coupling; SHUT NOZZLE OFF.

(8) Swing folded ends even with the nozzle and female coupling (figs. 106 and 107).

Figure 107.

(9) Place one hand under and other hand over folds at center, pivot over shoulder with nozzle and coupling on back (fig. 108).

(10) When removing folded hose from shoulder, hold nozzle and coupling with free hand until hose is off shoulder (fig. 109).

(11) Placing nozzle over shoulder.

(12) Grasp hose behind nozzle (fig. 110).

(13) By pivoting nozzle or nozzles on shoulder eliminates danger to others and injury to yourself.

b. Carrying Nozzles.

(1) Carry nozzle under arm or over shoulder as conditions warrant. When over shoulder, greater leverage can be exerted. Also, both hands are free to climb ladders. Empty lines on shoulder, loaded lines under arms (fig. 111).

Figure 108.

(2) The nozzle should be carried over the shoulder or under the arm nearest to the source of supply. (Safety, never cross line to opposite shoulder.)

c. Carrying Hose.

(1) Carry hose under arm or over shoulder as conditions warrant.

Figure 109.

Figure 110.

(2) Hose couplings should be carried in front of body at approximately arm's length.

(3) Slack hose should be provided near nozzle to facilitate moving-in without dragging additional hose.

d. Intervals When Carrying 1½- and 2½-inch Hose.

(1) The following intervals are based on the actual amount of hose between men; the

Figure 111.

Figure 112.

actual distance between men will vary with conditions.

(2) Fifty feet on empty lines carried on the level.

(3) Twenty-five feet on empty lines carried up ladders, stairways, fire escapes, etc.

(4) Fifteen to 20 feet on loaded lines carried on the level.

(5) Six to 10 feet on loaded lines carried up ladders, stairways, fire escapes, etc.

e. Lines Taken Aloft.

(1) Lines taken aloft should not be charged until they are in position.

(2) If necessary to take loaded lines aloft, the nozzle and hose should be carried under the *arm*.

(3) Above ground "Hose Layouts" where specific floors are involved, may be adapted to the other floors by changing position of men on ladders or fire escapes.

f. Ladders—1½- and 2½-inch Lines.

(1) Men on line up to designated intervals on same side of hose; carry nozzle, or nozzles, and hose over shoulder toward source of supply.

(2) Men carrying hose should allow slack hose to hang approximately to the ankles in front of body (fig. 112).

g. Fire Escapes—1½- and 2½-inch Lines.

(1) Men on line up to desinated intervals on same side of hose; carry nozzle or nozzles and hose over shoulder on side toward building.

(2) Men carrying hose should allow slack hose to hang approximately to the ankles in front of body (fig. 112).

h. Stairways—1½- and 2½-inch Lines.

(1) Men on line up at designated intervals on same side of hose, carry nozzle or nozzles and hose under arms or over shoulder.

i. Pulling and Securing Hose.

(1) When man at nozzle or nozzles reaches desired level, other men stop on fire escapes, balconies, stairways, landings, or lock-in on ladders, evenly spaced

(2) On signal of top man, all men pull hose until a sufficient amount is in position on fire floor.

(3) Secure 2½-inch hose to fire escape balcony railing, or to rungs of ladder, with hose strap placed behind coupling if within reach.

(4) It is not necessary to secure 1½-inch lines.

j. Taking Lines Aloft—Pike Pole—Hose Roller and Rope.

(1) If conditions are such that lines cannot be taken aloft by any of the methods outlined in "Hose Handling," other methods may be used such as:

(a) Attaching pike-pole to hose with hose strap, placing men on ends of fire escapes, balconies, or at windows of upper floors, and passing hose from man to man with pike-pole (fig. 113).

Figure 113.

Figure 114.

(b) Sending men aloft with hose roller and rope, securing hose roller to window sill or fire wall, lowering rope and attaching to hose with proper knot or knots and pulling hose aloft with rope (fig. 114).

k. Backing-Up Man at Nozzle.

(1) The purpose of backing up man at nozzle is to relieve him of the strain caused by the reactionary force of the nozzle stream.

Figure 115.

(2) Positions of men holding line should be staggered.

(3) Do not crowd man at nozzle.

(4) Hold line in same plane as nozzle whenever practicable.

(5) Keep line free of sharp bends and maintain if possible, approximately ten feet of straight line behind nozzle (fig. 115).

l. Method of Holding Hose.

(1) The method of holding hose depends largely on the number of men available, size of line, the pressure, location and length of time line is to be used.

Figure 116.

(2) Any of the following methods may be used singly, or in combination, as conditions warrant.

(a) Face towards nozzle; hold hose between arm and body; pass hand under hose and grasp wrist of other arm; grasp hose with free hand (fig. 115).

(b) Face hose; hold hose between body and arms, with arms crossed and hands grasping hose from under sides; twist body slightly toward nozzle (fig. 116).

(c) Two men place hose strap around hose a sufficient distance back to avoid interfering with man at nozzle; face toward nozzle; pass hose strap around front of body; hold handle of hose strap with outside hand; grasp hose

Figure 117.

with free hand; lean body against hose strap (fig. 117).

(d) Secure bar to hose with hose strap attached in such a manner as to have a turn around hose on each side of bar; 2 men face toward nozzle; hold bar with outside hands; lean body against bar, the 2 men proper distance behind nozzle man to eliminate interference (fig. 118).

m. Operating Nozzle From Ladder.

(1) Line up on hose at designated intervals.

(2) Proceed on ladder until nozzle is opposite where stream is to be directed.

(3) Place nozzle between rungs; attach hose strap immediately behind nozzle; pass handle of hose strap up behind first rung above; hook handle of hose strap (from front side of ladder) to second rung above hose (fig. 119).

Figure 118.

Figure 119.

(4) Secure hose to ladder with hose straps, below operator where necessary.

n. Connecting to Buildings Inlet Connections.

(1) Inlet connections are provided to augment the water supply or in some cases to charge the system.

Figure 120.

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(2) Inlet connections are found on some buildings equipped with exterior standpipes, interior standpipes, sprinkler systems, deluge systems, and water curtain systems and in certain cases refrigeration diffusers.

(3) Inlet connections are near the street or ground level and have clapper valves.

(4) Female swivels and threads are protected by plugs or breakable caps.

(5) Inlet connections are manifolded and arranged either vertically, horizontally or as a cluster (fig. 120).

(6) Identification of the type system is generally made by name plates. However, in numerous cases they are designated by lettering on a red background in accordance with navy color code.

(7) Two or more 2½″ hose lines should be used in connecting to inlet systems; however, under certain conditions, one line will suffice.

(8) Read identification plate to assure connecting to proper system.

(9) Remove protector plug or break cap on inlet connection; check gasket; check inlet for foreign material.

(10) Remove nozzle tip and connect shutoff butt to female inlet connection. Make up spanner tight.

(11) Open shutoff.

(12) Connect additional line, or lines, in same manner. Connect direct to inlet system from hose lines in absence of removable tip type shut-off nozzles as shown in fig. 120.

Chapter 5

FIRE FIGHTING EQUIPMENT AND ITS USE (continued)

Engine Companies

0501. ENGINE COMPANIES—BASIC OPERATIONS

1. Single- and Two-Piece Companies

Engine companies operate with 1 or 2 pieces of equipment depending on the size and strategic importance of the activity, its location, need for extra pumping apparatus, etc. Two-piece engine companies usually consist of two triple combination pumpers, and therefore such companies are often referred to as "Double Triples." The following basic operations are an explanation of the various duties that are encountered while performing a particular evolution. The various tasks encountered during any particular layout are illustrated for clarification. Thereafter, reference is made only to the individual who performs the particular task.

2. Taking Hydrant

a. Single 2½-Inch Line—Hydrant to Fire.

The apparatus should be slowed, or stopped if conditions warrant, a short distance before hydrant is reached. Slowing or stopping enables the man taking hydrant to step off with safety. Slowing before hydrant is reached, allows him to run toward the hydrant in the same general direction apparatus is traveling, thus avoiding pull on hose until it is snubbed.

(1) Place hydrant wrench sling on shoulder.

(2) Step off running board with female end of hose in one hand; and a fold of hose in other hand to provide sufficient slack for connecting to discharge gate of pump after removin hose from around hydrant. (Fig. 121.)

(3) Continue around hydrant, retaining a firm hold on hose to permit snubbing.

Figure 121.

(4) After sufficient hose (usually 2 or 3 sections) has been laid to prevent drag, pull hose in close to curb to permit spotting pumper without running over hose (figs. 122 and 123);

Figure 122.

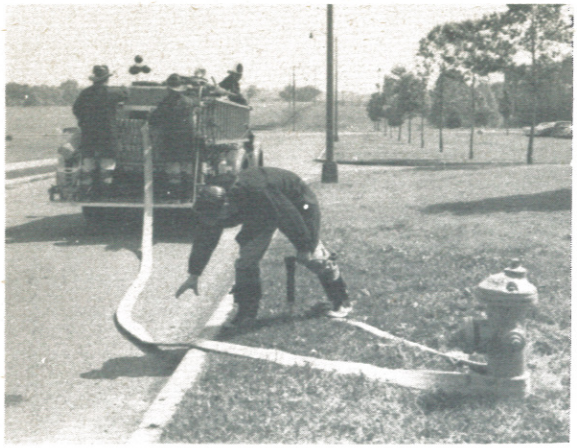

Figure 123.

remove hose from around hydrant; lay hydrant wrenches at base of hydrant; connect hose to discharge gate of pump (fig. 124).

(5) Be governed by order of Driver Operator (Engineer), assist to connect to hydrant, etc., when released, follow up line removing kinks and tightening loose couplings; assist men at nozzle.

b. Two 2½-Inch Lines Simultaneously—Hydrant to Fire.

When taking a hydrant with two 2½-inch lines simultaneously the apparatus must be stopped at the hydrant long enough for connection between compartments to be broken and both lines snubbed around hydrant.

(1) Place hydrant wrench sling on shoulder.

(2) Step off running board with female end of hose from one compartment in one hand,

Figure 124.

female end of hose from opposite compartment in other hand (fig. 125).

(3) Continue around hydrant with sufficient slack hose to reach discharge gates of pump after removing hose from around hydrant (men on rear of apparatus to provide necessary slack) retain firm holds on hose to permit snubbing; signal for apparatus to proceed.

(4) After sufficient hose (usually 2 or 3 sections) has been laid to prevent drag, pull hose in close to curb to permit spotting pumper without running over hose; remove hose from around hydrant; lay hydrant wrenches at base of hydrant; connect both lines to discharge gates of pump. (One line connected to hydrant from triples.)

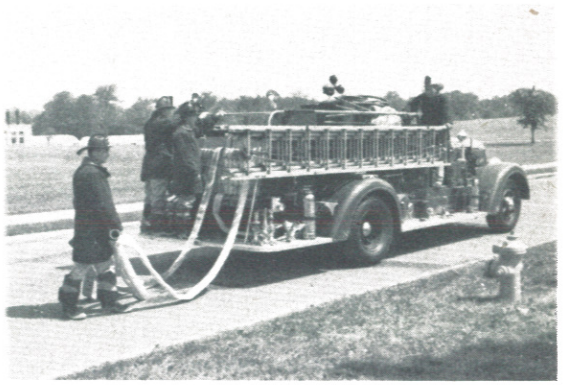

Figure 125.

(5) Be governed by order of Driver Operator (Engineer), assist to connect to hydrant, etc.; when released, follow up lines removing kinks and tightening loose couplings; assist men at nozzle (fig. 124).

c. Reverse Lay—Taking Hydrant.

(1) Fire to hydrant—single 2½-inch line.

In a reverse lay, after operations are performed at the fire location, the driver will proceed to hydrant with apparatus; when apparatus stops, the driver will remove sufficient hose to reach discharge gate; disconnects coupling on line; replaces female end of hose and slack in compartment; connects male end to discharge gate, using a double female connection; if two piece company, driver assists engineer, when released returns the wagon to the fire and goes to work with his company (fig. 126).

Figure 126.

d. Split Layout—Single 2½-inch Line.

(1) Intersection to Fire and Hydrant—Split Layouts. Under certain conditions it may be necessary to lay a line from a street intersection or other location in two directions to save time in laying a hose line. When this operation is necessary the two pieces of fire apparatus will stop at the separation point and connect the female end of hose from wagon compartment to female end of hose from pumper compartment, a double male connection is necessary (fig. 127).

(2) When connection is made the pumper will proceed to hydrant, while apparatus is proceeding to fire (fig. 127). Officer in charge will send hydrant man to assist engineer. When hydrant man is released, he will follow up line, eliminating kinks, tighten couplings and go to work with his company.

3. Laying Lines (position on street)

a. Hose lines should be laid on hydrant side of street to minimize running over hose by other apparatus responding to fire.

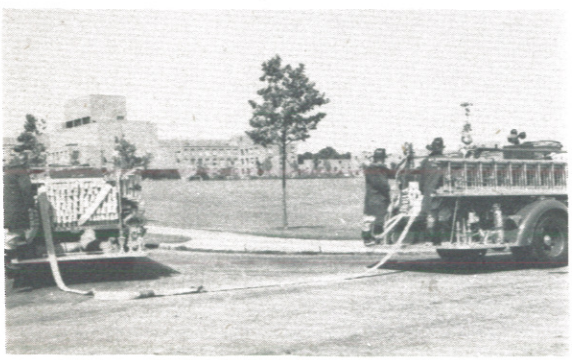

Figure 127.

b. Apparatus should be stopped a sufficient distance beyond fire, wherever practicable, to permit removing hose directly in front of fire.

4. At Fire—Removing Single 2½-Inch Hose Line

a. Hose is removed in folds and laid out behind apparatus to avoid kinks, tangles, and permit faster calculation of the amount removed (fig. 128).

b. The proper fold to remove is the first fold in compartment that permits the removal of 50 feet of hose when running back approximately 25 feet.

c. Before pulling fold, flip it up and turn flat, to prevent binding between hose folds in bed.

Figure 128.

d. Grasp proper fold; run back until approximately 50 feet of hose is clear of apparatus; lay fold on fire side of main line, as close as possible.

e. Remove additional folds in same manner until required amount of hose to cover the fire is laid (fig. 128).

5. At Fire—Removing Two 2½-inch Hose Lines Simultaneously (hydrant to fire)

a. Hose is removed from each compartment in the same manner as a single line, except that, hose leading out of compartment farthest from fire should be flipped away from other

Figure 129.

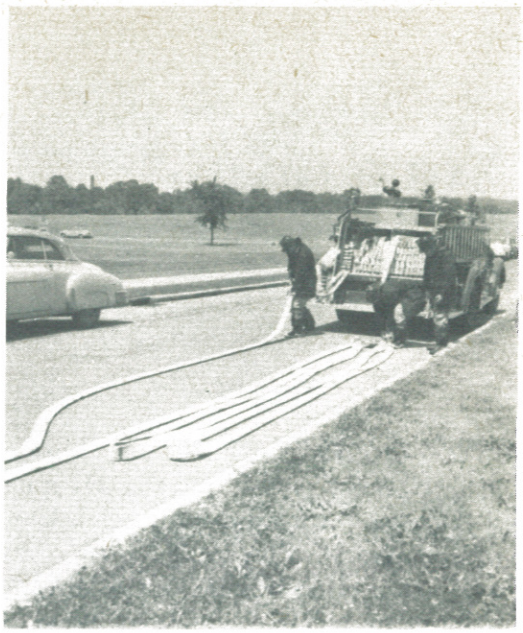

Figure 131.

lines to provide a clear space to lay folds (figs. 129 and 130).

b. If conditions of manpower, strategy, etc., indicate that it is advisable, the second line laid on side away from the fire may be disconnected immediately out of the compartment and a shutoff nozzle placed thereon. This line may be extended if necessary (fig. 131).

Figure 130.

6. At Fire—Removing 2½-Inch Hose—Alternate Method (fig. 132)

a. Grasp proper fold, run back until approximately 50 feet of hose is clear of apparatus, lay fold down on fire side of main line, continue until proper amount of hose is removed.

b. Last fold off can be pivoted directly toward fire, continue with next fold in like manner, this will eliminate the pivoting folds behind apparatus becoming fouled. In pivoting folds, men can take two folds at once (fig. 132). In reverse lays, the folds can be pivoted as removed from apparatus.

c. On triple combination apparatus with fire on opposite side of street; lay folds away from fire to permit clearing of area behind

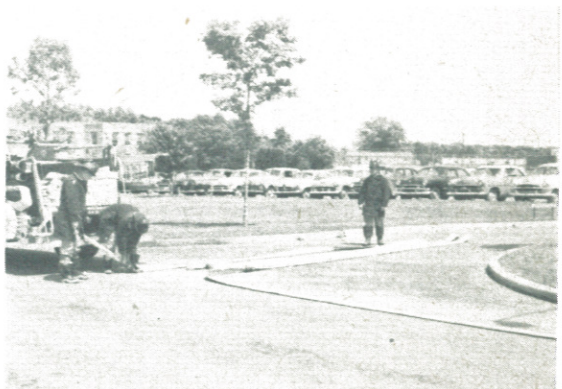

Figure 132.

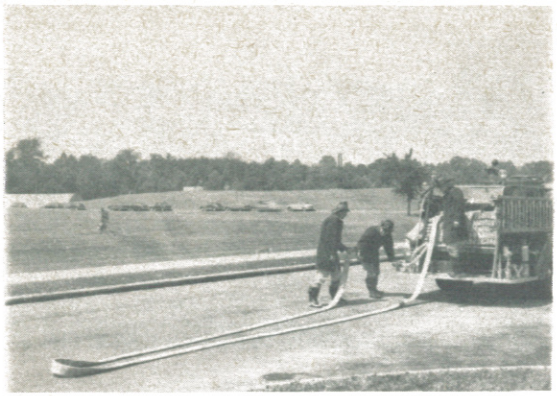

Figure 133.

apparatus; triple may then immediately back to hydrant.

7. At Fire Removing Single 2½-Inch Line (fire to hydrant)

a. Remove hydrant wrench from hose compartment and place on apparatus in such a manner as to be secure and to avoid interfering with hose as it is being laid.

b. Grasp female end of hose with one hand, grasp proper fold with other hand; run back until first coupling is clear of apparatus; lay fold on ground; carry female coupling to rear of apparatus on side toward fire.

c. Lay additional folds on side of hose away from fire (fig. 133).

d. When Reducing to Wyed 1½-inch lines, carry female end of 2½-inch hose to wye assembly. Lay additional folds on side of hose away from 1½-inch hose compartment (figs. 134 and 135).

8. Standing on Hose (fire to hydrant)

a. When laying a 2-½-inch line from fire to hydrant it is necessary to stand on the hose

Figure 134.

Figure 135.

until a sufficient amount (usually 3 sections) has been laid to prevent drag.

b. Stand at side of hose facing folds 8 to 10 feet from rear of apparatus; place foot on hose; place other foot forward to brace body; grasp hose with both hands; raise sufficiently to be in position to take strain as hose is being laid (fig. 136); SIGNAL driver to proceed.

c. When Reducing to Wyed 1½-inch lines, the anchor man gives "SIGNAL" when the 1½-inch hose couplings are leaving the compartment, or when 50 feet of 1½-inch has been removed, if the Wye assemblyman has assembly off holder on apparatus and is braced.

Figure 136.

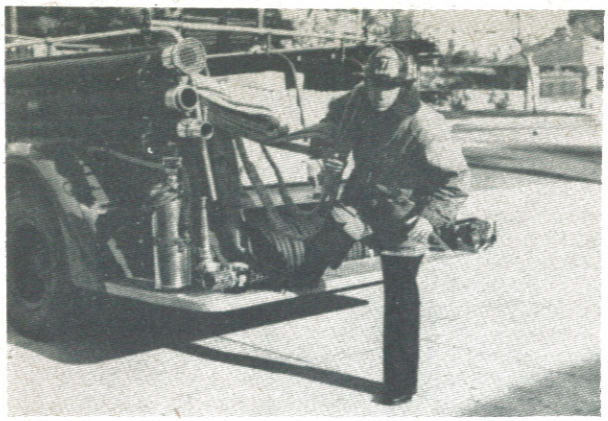

Figure 136b.

9. Removing 1½-Inch Hose at Fire.

a. Removing 1½-inch lines combine the operation of removing and leading-in.

b. In hydrant to fire layouts the 1½-inch hose is removed after sufficient 2½-inch hose has been laid out, coupling disconnected and male end of hose connected to Wye assembly (fig. 137).

c. In fire to hydrant layouts the 1½-inch hose is removed after sufficient 2½-inch hose has been laid out, the female coupling is connected to the 1½-inch Wye assembly, using a double male connection.

d. Place nozzles on back with hose over shoulder (if over right shoulder, hold hose with left hand; if over left shoulder, hold hose with right hand). Grasp hose, with free arm over lines on shoulder and hand extended through folds (fig. 136b).

e. Run back until approximately 50 feet of hose has been removed; turn toward fire; lead-in (figs. 137 and 138).

Figure 137.

Figure 138.

f. When sufficient hose is laid out to prevent fouling, anchor man will step off hose and line up at the center couplings and assist leading-in the 1½-inch hose. The Wye assemblyman will follow up leading-in, carrying the 1½-inch assembly to the point desired, after the Wye assembly is in position he will charge the 1½ lines.

10. Dual Compartments for 1½-Inch Hose

Figure 139 shows a triple combination 750 g. p. m. class "A" pumper loaded with 2 sets of 1½-inch leader lines. Such an arrangement may be desirable in certain areas for the following reasons:

a. Elimination of carrying an 1½-inch pack.

b. Leader lines are always available for a right or left lead-in.

c. A 1½-inch assembly is available for second 2½-inch lay.

d. Two sets of leader lines can be laid simultaneously.

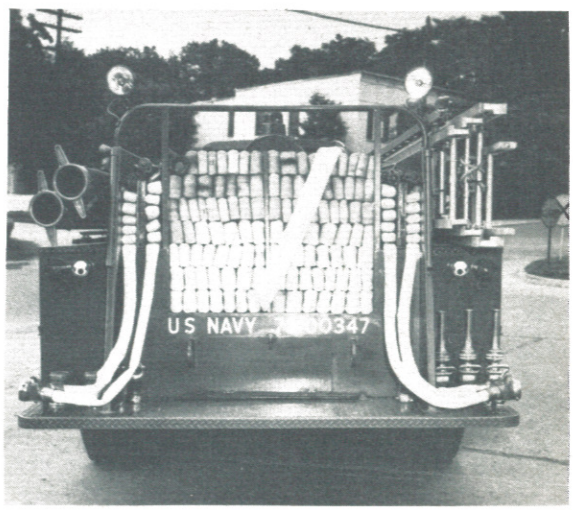

Figure 139.

e. A time saver when two 1½ assemblies are necessary.

11. Engine Company—Evolutions

a. Positions by numbers.

(1) Duties designated.

(a) Numbers are used in the following hose layouts to indicate the various duties that must be performed, and, in a broader sense, the members to perform these duties.

(b) Owing to days-off, sick leave, annual leave, and special details, it is recognized that a company will seldom have the number of men riding on apparatus indicated in the drill manual. The sequence of operations, however, remains the same no matter how few the men assigned to the company.

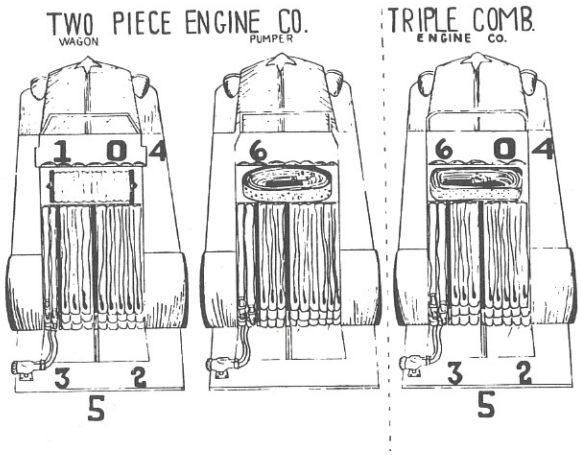

Figure 140.

Therefore, when circumstances permit, the company officer will often assist, and the remaining available men will perform whatever manipulations are next in sequence until the evolution is completed. It must not be assumed that because a member has been assigned a number that he will perform only the duties indicated for such number.

(c) If a member assigned to perform a certain operation is otherwise occupied, the operation shall be completed by any member available; such member temporarily assumes the number indicated by the duties he performs.

(2) Positions of Members on Apparatus of Two-piece Engine Companies. Members assigned to the various duties will usually ride on apparatus in designated positions (fig. 140).

(a) Hose Wagon.

(1) No. 1—driver.

(2) Nos. 2, 3, and 5, on rear running board in position to perform assigned duties.

(3) No. 4 forward (next to company officer, where, as relief officer, he is in a position to assist and be trained).

(b) Pumper. No. 6—Driver Operator (Engineer).

(3) Positions of Members on Triple Combination Companies.

(a) No. 6—Driver Operator (Engineer).

(b) Nos. 2, 3, and 5 on rear running board in position to perform assigned duties.

(c) No. 4—forward (next to company officer, for same reason as stated in two-piece company assignment).

NOTE. Where the apparatus is designed to carry men in the cab, only No. 2 rides on the rear running board.

(4) Ladders on Engine Companies.

(a) Two-piece Companies.

(1) No. 1 will remove ladders if needed and will raise ladder when line is laid from hydrant to fire.

(2) No. 2 will raise ladder when line is laid from fire to hydrant.

(b) Triple combination companies.

(1) No. 6 will remove ladders if needed.

(2) No. 5 will raise ladders if needed upon completion of his other duties.

(5) Removal of other Equipment.

On Triple Combination Companies, No. 5 will remove the axe and pile pole; also the 1½" hose pack (if carried), whenever a single 2-½" line is laid; if no hose pack is carried he will remove the 1½" hose from compartment.

(6) Backing around Hose (Triple Combination Companies).

In hydrant to fire lay-outs when fire is on the opposite side of the street from side on which line has been laid, hose line or lines should not be led-in until apparatus has backed sufficiently to permit leading in around front of apparatus.

(7) Charging Hose Lines.

(a) The Driver Operator (Engineer)—No. 6—will be responsible for charging hose

lines at proper time unless otherwise ordered. Signals in general use are illustrated in Fig. 141.

(b) Where the topography or other conditions are such that the Engineer is frequently in no position to easily observe whether or not lines are ready to be charged (e. g., long lays, obstructed vision, etc.), it is a common practice to use a small, lightweight, quick-snapping hose clamp on the supply line in front of the fire. Where this practice is followed, the first step in any evolution of laying off hose in front of the fire (on forward lays) is to place such a clamp on the line a short distance behind the hose bed; also, its removal is the last step in the sequence of operations at the apparatus prior to placing the hose line into operation.

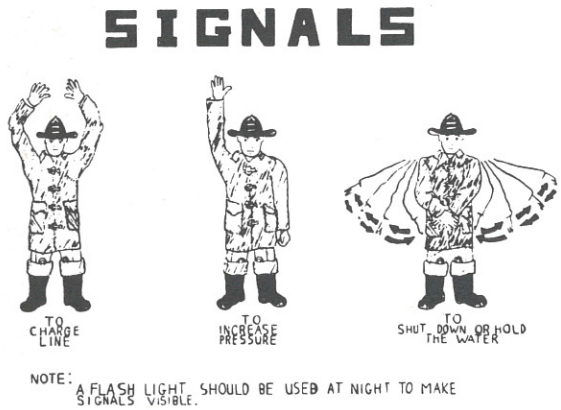

Figure 141.

0502. ENGINE COMPANIES—HOSE LAY-OUTS

1. Hose Layouts Two-piece Engine Company

a. LAY-OUT No. 1 (Two-piece engine company).

Hydrant to Fire—Single 2½-inch Line.

Ground Level.

(1) No. 1 stops wagon at hydrant to permit No. 2 to step off rear running board with safety.

(2) No. 2 takes hydrant.

(3) No. 1 continues to fire with wagon.

(4) No. 6 spots pumper; makes connection.

(5) No. 2 assists No. 6.

(6) No. 1 stops wagon at fire.

(7) Officer orders amount of hose needed.

(8) No. 3 removes first fold of hose.

(9) No. 5, 4, 1, and 3 continue removing hose until sufficient amount has been removed.

(10) No. 3 disconnects coupling; hands male end to No. 4; replaces female end and slack hose in compartment.

(11) No. 4 obtains nozzle; connects to male end of hose; shuts nozzle off; leads-in.

(12) Nos. 3, 5 and 1 line up on hose; assist No. 4 to lead-in; pull slack hose towards nozzle; lay hose down; advance and back-up No. 4 at nozzle.

(13) No. 2 or No. 6 open hydrant.

(14) No. 6 responsible for charging line when hose is in position at fire.

(15) No. 2, when released by No. 6, follows up line, removing kinks and tightening loose couplings; assists men at nozzle.

b. LAY-OUT No. 2. Fire to hydrant—Single 2½-inch Line.

Ground Level.

(1) No. 1 stops wagon at fire.

(2) No. 6 continues to hydrant; spots pumper; makes hydrant connections.

(3) Officer orders amount of hose needed.

(4) No. 3 removes first fold of hose; carries female end to rear running board on side toward fire, hands to No. 4.

(5) Nos. 2 and 5 continue removing hose.

(6) No. 4 obtains nozzle with double male attached; connects to female end of hose; shuts nozzle off; leads-in.

(7) No. 3 lines up on hose; assists No. 4 to lead-in.

(8) No. 5 stands on hose when sufficient amount has been removed; gives signal to No. 1 to proceed.

(9) No. 1 proceeds to hydrant with wagon.

(10) No. 2 lines up on hose; assists Nos. 4 and 3 to lead-in.

(11) No. 5 gets off hose when sufficient line has been laid to prevent drag; lines up on hose; assists Nos. 4, 3, and 2 to lead-in.

(12) Nos. 3, 2 and 5 pull slack hose toward nozzle; lay hose down advance and back-up No. 4 at nozzle.

(13) When wagon stops at hydrant No. 1 removes sufficient hose to reach discharge gate of pump; disconnects coupling; replaces female end and slack hose in compartment; connects male end to discharge gate of pump using double female, assists No. 6.

(14) No. 1 or No. 6 open hydrant.

(15) No. 6 responsible for charging line when connections are made.

(16) No. 1 when released by No. 6, returns to fire with wagon; assist men at nozzle.

c. LAY-OUT No. 3. Hydrant to Fire—Single 2½-inch Line—Reduced to Wyed 1½-inch Lines.

Ground Level.

(1) No. 1 slows wagon at hydrant to permit No. 2 to step off rear running board with safety.

(2) No. 2 takes hydrant.

(3) No. 1 continues to fire with wagon.

(4) No. 6 spots pumper; makes hydrant connections.

(5) No. 2 assists No. 6.

(6) No. 1 stops wagon at fire.

(7) Officer orders amount of 2½" hose needed.

(8) No. 3 removes first fold of hose.

(9) Nos. 5, 4, 1 and 3 continue removing hose until sufficient amount has been removed.

(10) No. 3 disconnects coupling; hands male end to No. 4; replaces female end and slack hose in compartment.

(11) No. 4 connects male end of hose to wye assembly, removes wye assembly and carries when leading-in.

(12) No. 3 takes both 1½-inch nozzles; lead(s)-in.

(13) Nos. 5, 4 and 1 line up on hose; assist No. 3 to lead-in; pull slack hose toward nozzle; lay hose down.

(14) No. 5 advances and takes one nozzle from No. 3.

(15) No. 4 opens shut-offs on 1½-inch wye.

(16) Nos. 4 and 1 advance and back-up men at nozzles.

(17) No. 2 or No. 6 opens hydrant.

(18) No. 6 responsible for charging line when hose is in position at fire.

(19) No. 2, when released by No. 6, follows up line removing kinks and tightening loose couplings; assist men at nozzle.

d. LAY-OUT No. 4. Fire to Hydrant—Single 2½-inch Line—Reduced to Wyed 1½-inch Lines.

Ground Level.

(1) No. 1 stops at fire.

(2) No. 6 continues to hydrant; spots pumper; makes hydrant connections.

(3) Officer orders amount of hose needed.

(4) No. 3 removes first fold; carries female end to wye assembly, hands to No. 4.

(5) Nos. 2 and 5 continue removing hose.

(6) No. 4 connects female end of hose to wye assembly (double male connection is necessary); removes wye assembly and braces himself to receive drag of 1½-inch hose when wagon starts.

(7) No. 3 takes both 1½-inch nozzle; leads-in, assisted by No. 4.

(8) No. 5 stands on hose when sufficient amount has been removed; gives signal for No. 1 to proceed when 1½-inch couplings are leaving compartment (50 feet off).

(9) No. 1 proceeds to hydrant with wagon.

(10) No. 2 lines up on hose; assists Nos. 3 and 4 lead-in.

(11) No. 5 gets off hose when sufficient amount has been laid to prevent drag; assists Nos. 3, 2 and 4 lead-in.

(12) Nos. 2, 4 and 5 pull slack hose toward nozzle; lay hose down.

(13) No. 2 advances and takes one nozzle from No. 3.

(14) No. 4 opens shutoffs on 1½-inch wye; advances and backs up man at one nozzle; No. 5 advances and backs up man at other nozzle.

(15) When wagon stops at hydrant, No. 1 removes sufficient hose to reach discharge gate of pump; disconnect coupling; replaces female end and slack in compartment; connects male end to discharge gate of pump, using double female; assists No. 6.

(16) No. 1 or No. 6 opens hydrant.

(17) No. 6 responsible for charging line when hose is in position at fire.

(18) No. 1, when released by No. 6 returns to fire with wagon; assists men at nozzle.

e. LAY-OUT No. 5. Hydrant to Fire—Two 2½-inch lines—Simultaneously.

Ground Level.

(1) No. 1 stops wagon at hydrant.

(2) Men on rear running board disconnect couplings between compartments.

(3) No. 2 takes hydrant; Nos. 3 and 5 assist in removing hose to provide slack; No. 2 gives signal for No. 1 to proceed.

(4) No. 1 proceeds to fire with wagon.

(5) No. 6 spots pumper; makes connections to hydrant.

(6) No. 2 connects both lines to discharge gates of pump; assists No. 6.

(7) No. 1 stops wagon at fire.

(8) Officer orders amount of hose needed.

(9) Nos. 3 and 4 remove hose from compartment on side toward fire.

(10) Nos. 5 and 1 remove hose from other compartment.

(11) Nos. 3 and 1 disconnect couplings; hand male ends to Nos. 4 and 5; replace female ends and slack in compartment.

(12) Nos. 4 and 5 obtain nozzles; connects to male end of hose; lead-in.

(13) No. 3 lines up on hose; assists No. 4 to lead-in; pull slack hose toward nozzle; lays hose down; advances and backs up No. 4 at nozzle.

(14) No. 1 lines up on hose; assists No. 5 to lead-in; pull slack hose toward nozzle; lays hose down; advances and backs up No. 5 at nozzle.

(15) No. 2 or No. 6 opens hydrant.

(16) No. 6 responsible for charging line when hose is in position at fire.

(17) No. 2, when released by No. 6, follows up lines, removing kinks and tightening loose couplings; assists men at nozzle.

(18) If conditions of manpower, strategy, etc., indicate that it is advisable, the second line, laid on side away from fire, may be disconnected immediately out of the bed and a shut-off placed thereon. This line may be extended later if needed.

f. LAY-OUT No. 6. Fire to Hydrant—Single 2½-inch Line—Pump Laying Line.

Ground Level.

(1) No. 1 stops wagon at fire.

(2) No. 6 stops pump beside wagon.

(3) No. 2 takes position on rear running board of pump; proceeds to hydrant with pump.

(4) No. 5 takes female coupling and fold of hose from pump bed; binds around wagon; gives signal for No. 6 to proceed to hydrant. No. 5 anchors hose.

(5) Officer orders amount of hose needed.

(6) No. 3 removes first fold of hose from wagon; carries female end to rear running board on side away from fire and lays down.

(7) Nos. 4 and 3 continue removing hose from wagon; assisted by No. 5 after sufficient hose has been laid by pump to prevent drag.

(8) No. 1 obtains double male; connects to female end of hose laid by pump; connects line leading from wagon to the male connection.

(9) No. 3 disconnects coupling; hands male of hose to No. 4; replaces female end and slack hose in compartment.

(10) No. 4 obtains nozzle; connects to male end of hose; shuts nozzle off; leads in.

(11) Nos. 3, 5 and 1 line up on hose; assist No. 4 to lead-in; pull slack hose toward nozzle; lay hose down; advance and back up No. 4 at nozzle.

(12) No. 6 responsible for charging line when hose is in position at fire.

(13) No. 2, when released by No. 6, follows up line, removing kinks and tightening hose couplings, assist men at nozzle.

g. LAY-OUT No. 7. Hydrant to Fire—Extension Lay—Single 2½-inch Line.

Ground Level.

(1) No. 1 slows wagon at hydrant to permit No. 2 to step off rear running board with safety.

(2) No. 2 takes hydrant.

(3) No. 1 continues to fire with wagon.

(4) No. 6 spots pumper; make connections.

(5) No. 2 assists No. 6.

(6) No. 1 stops wagon at fire.

(7) No. 3 disconnects couping (in line laid from hydrant) nearest rear running board, hands male end to No. 5; hands female end to No. 4.

(8) No. 5 obtains nozzle; connects to male end of hose; shuts nozzle off, removes tip; lays shutoff down; places tip on wagon.

(9) No. 4 obtains nozzle with double male attached; connects to female end of hose; shuts nozzle off; leads in.

(10) Nos. 3 and 5 line up on hose as it leaves compartment; assist No. 4 to lead-in; pull slack hose toward nozzle; lay hose down; advance and back up No. 4 at nozzle.

(11) No. 1 stands at end of compartment; assists in removing hose; disconnect coupling when word is relayed back from the officer that sufficient hose has been removed; replaces female end and slack hose in compartment; connects male end to shutoff on original line, using double female; open shutoff; advances and assists men at nozzle.

(12) No. 2 or No. 6 opens hydrant.

(13) No. 6 responsible for charging line after nozzle has been connected to original line.

(14) No. 2, when released by No. 6, follows up line, removing kinks and tightening loose couplings, assists men at nozzle.

h. LAY-OUT No. 8—"A". Hydrant to Fire—Single 2½-inch Line to Second Floor—Via Ladder and Fire Escape.

(1) Complete LAY-OUT No. 1 to base of ladder.

(2) No. 4 places nozzle on back with hose over shoulder; proceeds up ladder.

(3) Nos. 3 and 5 line up with hose over shoulder on same side as No. 4; follow up ladder.

(4) No. 1 remains on ground near base of ladder.

(5) No 4 gets on balcony; continues in window; places nozzle to one side; pulls in slack hose.

(6) No. 3 gets on balcony; remains near top of ladder.

(7) No. 5 locks-in at center of ladder.

(8) Upon signal from No. 3, Nos. 3, 5 and 1, working in unison, pull hose for No. 4 until sufficient amount is in on second floor.

(9) Nos. 3 and 1 place hose over end of balcony to clear ladder; No. 3 secures hose to balcony railing with hose strap.

(10) No. 4 takes nozzle; leads-in.

(11) Nos. 3, 5 and 1 proceed in on second floor; backing up No. 4 at nozzle.

i. LAY-OUT No. 8—"B". Fire to Hydrant—Single 2½-inch Line to Second Floor—Via Ladder and Fire Escape.

(1) Complete LAY-OUT No. 2 to base of ladder. The operations are the same as in laying from hydrant to fire (LAY-OUT No. 8–"A") with the following exceptions:

(2) No. 2 assumes the duties of No. 1 on hose while line is being laid.

(3) No. 5 proceeds to position after anchoring hose.

j. LAY-OUT No. 8—"C"—Lowering Line.

(1) Members assume original position on fire escape, ladder and ground.

(2) When line is drained, all members lower in unison.

k. LAY-OUT No. 9—"A". Hydrant to Fire—Single 2½-inch Line—Reduced to Wyed 1½-inch Lines to Second Floor—Via Ladder and Fire Escape.

(1) Complete LAY-OUT No. 3 to base of ladder.

(2) No. 3 places both 1½-inch nozzles on back with hose over shoulder; proceeds up ladder.

(3) Nos. 5 and 1 line up with hose over shoulder on same side as No. 3; follow up ladder.

(4) No. 4 places wye assembly on ground near base of ladder; remains on ground.

(5) No. 3 gets on balcony; continues in window; places nozzles to one side; pulls in slack hose.

(6) No. 5 gets on balcony; remains near top of ladder.

(7) No. 1 locks in at center of ladder.

(8) Upon signal from No. 5, Nos. 5, 1 and 4, working in unison, pull hose for No. 3.

(9) When all slack 1½-inch hose has been passed up, No. 4 places hose over shoulder with wye assembly in front of body; proceeds up ladder; No. 1 places hose over shoulder; unlocks from ladder; proceeds to balcony; No. 3 proceeds in on second floor.

(10) No. 1 takes wye assembly from No. 4 at top of ladder; places wye assembly in window; remains on balcony.

(11) No. 4 locks-in on ladder.

(12) Nos. 1 and 4 pull hose for Nos. 5 and 3 until sufficient amount is on second floor.

(13) Nos. 5 and 3 takes a nozzle; lead-in.

(14) No. 1 places hose over end of balcony to clear ladder; secures hose to balcony railing with hose strap.

(15) No. 4 proceeds to wye assembly; opens shut-off(s) on 1½-inch wye.

(16) Nos. 1 and 4 advance and back up men at nozzles.

l. LAY-OUT No. 9—"B". Fire to Hydrant.

(1) Complete LAY-OUT No. 4 to base of ladder.

The operations are the same as from hydrant to fire (LAY-OUT No. 9—"A") with the following exceptions:

(2) No. 2 assumes duties of No. 1 on hose while line is being laid.

(3) No. 3 proceeds up ladder with 1½-inch nozzles.

(4) No. 5 proceeds to position of No. 3 after standing on hose.

WHEN NOT NECESSARY TO TAKE WYE ASSEMBLY ALOFT.

(5) Nos. 3 and 4 place 1½-inch hose over end of balcony to clear ladder (no hose strap required on 1½-inch hose).

(6) No. 4 opens shutoff on 1½-inch wye before proceeding up ladder to back up man at nozzle.

m. LAY-OUT No. 9—"C". Lowering Line.

(1) Members resume original positions on fire escape, ladder and ground.

(2) Drain line; all members lower in unison.

n. LAY-OUT No. 10—"A". Hydrant to Fire—Single 2½-inch Line to Fire Floor—Via Ladders.

(1) Complete LAY-OUT No. 1 to base of ladder.

(2) No. 4 places nozzle on back with hose over shoulder; proceeds up ladder.

(3) Nos. 3, 5 and 1 line up with hose over shoulder on same side as No. 4; follow up ladder.

(4) No 4 continues in fire floor window; lays nozzle to one side; pulls in slack hose.

(5) No. 3 (if not needed on ladder) on directions of No. 4 continues in fire floor window; picks up nozzle and proceeds to fire.

(6) No. 4 remains at window and directs Nos. 5 and 1 (also No. 3 if needed) to lock-in on ladder when properly spaced.

(7) Upon signal from No. 4 all men working in unison pull hose.

(8) When sufficient hose is on fire floor, men place hose on rungs of ladder next to beam; secure hose to ladder with hose straps.

(9) No. 4 places hose on window sill to clear top of ladder; proceed in on the fire floor with nozzle.

(10) Men on ladder unlock; proceed in on fire floor; Nos. 3, 5 and 1 assist No. 4 at nozzle.

(11) Men on ladders to be approximately 12 to 18 feet apart when pulling hose.

o. LAY-OUT No. 10—"B". Fire to Hydrant.

(1) Complete LAY-OUT No. 2 to base of Ladder.

The operations are the same as when laying from hydrant to fire (LAY-OUT No. 10—"A") with the following exceptions:

(2) No. 2 assumes duties of No. 1 on hose while line is being laid.

(3) No. 5 proceeds to position after standing on hose.

p. LAY-OUT No. 10—"C". Lowering Line.

(1) Members return to original positions.

(2) When line is drained, allow to slide down ladder until all slack is down.

(3) Man at top of ladder has nozzle placed over shoulder by No. 4; all men unlock and proceed down in unison.

q. LAY-OUT No. 11—"A". Hydrant to Fire—Single 2½-inch Line to Fifth Floor—Via Ladder and Fire Escape.

(1) Complete LAY-OUT No. 1 to base of ladder.

(2) No. 4 places nozzle on back with hose over shoulder that will be next to building when climbing fire escape; proceed up ladder and fire escape.

(3) Nos. 3, 5 and 1 line up with hose over shoulder on same side as No. 4 follow up ladder and fire escape.

(4) No. 4 goes under guard rail of each balcony and places nozzle in window of fifth floor; remains on balcony.

(5) Nos. 3, 5 and 1 stop on balconies, No. 3 at fourth floor; No. 5 at third floor; No. 1 at second floor.

(6) Upon signal from No. 4 all men, working in unison, pull hose until sufficient amount is on fifth floor.

(7) Nos. 4, 3 and 5 secure hose to guard rail with hose strap; No. 1 places hose over end of balcony to clear ladder; secures hose to balcony railing with hose strap.

(8) No. 4 takes nozzle; leads-in.

(9) Nos. 3, 5 and 1 proceed to fifth floor; back-up No. 4 at nozzle.

r. LAY-OUT No. 11—"B". Fire to Hydrant.

(1) Complete LAY-OUT No. 2 to base of ladder.

The operations are the same as when laying from hydrant to fire with the following exceptions:

(2) No. 2 assumes the duties of No. 1 on hose while line is being laid.

(3) No. 5 proceeds to position after standing on hose.

s. LAY-OUT No. 11—"C". Lowering Line.

(1) Members assume original positions on fire escape balconies.

(2) When line is drained, slack hose is lowered; members then descend fire escape and ladder in unison carrying hose.

t. LAY-OUT No. 12—"A". Connecting to Standpipe Outlet on Fire Floor—Two 2½-inch Lines Into Standpipe; Hose Packs to Upper Floor, via Ladder and Fire Escape.

(1) Complete LAY-OUT No. 5 until hose is removed.

(2) Nos. 3 and 5 take hose packs; proceed up ladder and fire escape to balcony at fire floor.

(3) Nos. 4 and 1 disconnect couplings; replace female ends and slack hose in compartment; obtains nozzles; connect to male ends of hose; shut nozzles off; lead-in to standpipe; remove nozzle tips; connect to standpipe inlets (spanner tight); open shut-offs.

(4) Nos. 3 and 5 remove hose packs on balcony at fire floor.

(5) No. 3 opens pack, places nozzle inside window; passes female end of hose around outer edge of balcony to No. 5; provides slack hose to reach standpipe outlet; secures hose to balcony railing with hose straps; (Assists to extend line if necessary.)

(6) No. 5 connects female end of hose to standpipe outlet, keeping hose around outer edge of balcony; secures hose to balcony with hose strap; (assists to extend line if necessary); opens gate valve when nozzle is in position.

(7) No. 4 proceeds to fire floor; takes nozzle; leads-in.

(8) No. 1 takes third hose pack aloft if needed.

(9) Nos. 3, 5 and 1 advance and back up No. 4 at nozzle.

u. LAY-OUT No. 12—"B". Connecting to Standpipe Outlet on Floor Below Fire.

The operations are the same as when connecting to outlet on fire floor with the following exceptions:

(1) No. 5 stops on balcony at floor below fire.

(2) No. 3 lowers female end of hose over balcony railing to No. 5; secures with hose strap.

(3) No. 5 connects to standpipe outlet on floor below fire.

(4) No. 5 does not secure hose to balcony railing.

v. LAY-OUT No. 12—"C". Lowering Line.

(1) Members assume equal distance on fire escape balconies.

(2) When line is drained, slack hose is lowered; members then descend fire escape in unison carrying hose.

(3) Female coupling of last section aloft is connected to second floor standpipe outlet; nozzle is lowered to ground and standpipe is drained (street connection can be drained by opening clapper valve with spanner).

w. LAY-OUT No. 13—"A". Connecting to standpipe outlet on fire floor—Two 2½-inch Lines into standpipe; Single 2½-inch Line (working line) to fire floor, via Ladder and Fire Escape.

(1) Complete LAY-OUT No. 5 until couplings are disconnected.

(2) Nos. 4 and 1 obtain nozzles; connect to male end of hose; shut nozzles off; lead-in to standpipe; remove nozzle tips; connect to standpipe inlet (spanner tight), using center or lower inlets first in order to make easier the connecting of additional lines; open shutoffs. NOTE: It is expected that most replacement nozzles will not have a shut-off butt; in which case the nozzles will be removed and hose coupling connected directly to the standpipe inlet manifold.

(3) Nos. 5 and 3 remove hose needed aloft from compartment on side away from fire.

(4) No. 5 disconnects coupling; hands male end to No. 3; replaces female end and slack hose in compartment.

(5) No. 3 obtains nozzle; connects to male end of hose; shuts nozzle off; places nozzle on back with hose over shoulder that will be next to building when climbing fire escape; proceeds up ladder and fire escape.

(6) Nos. 5, 4 and 1 line up with hose over shoulder on same side as No. 3; follow up ladder and fire escape.

(7) No. 3 continues to fire floor balcony; goes under guard rail; places nozzle in window; remains on balcony.

(8) Nos. 5, 4 and 1 stop on proper balconies, to provide best team work.

(9) Upon signal from No. 3, all men working in unison, pull hose until female coupling passes them; proceed to fifth floor.

(10) No. 3 passes female end of hose around outer edge of balcony to No. 5; provide slack hose to reach standpipe outlet, secures hose to balcony railing with hose strap.

(11) No. 5 connects female end of hose to standpipe outlet, keeping hose around outer edge of balcony; secures hose to balcony railing with hose strap; opens gate valve after nozzle is in position.

(12) No. 4 proceeds to nozzle; leads-in.

(13) Nos. 3, 5 and 1 advance and back up No. 4 at nozzle.

x. LAY-OUT No. 13—"B". Connecting to Standpipe Outlet on Floor Below Fire.

The operations are the same as when connections to outlet on the fire floor with the following exceptions:

(1) No. 5 remains on balcony at floor below fire when hose is pulled up.

(2) When female coupling reaches floor below fire, No. 5 connects to standpipe outlet.

(3) No. 5 does not secure hose to balcony railing.

y. LAY-OUT No. 13—"C". Lowering Line.

(1) Members assume original positions on fire escape balconies.

(2) When line is drained, slack hose is lowered; members then descend fire escape in unison carrying hose.

(3) Female coupling of last section aloft is connected to second floor standpipe outlet; nozzle is lowered to ground and standpipe is drained.

2. Hose Lay-Outs (Triple Combination Engine Company)

a. LAY-OUT No. 1. Hydrant to Fire—Single 2½-inch Line.

Ground Level.

(1) No. 6 slows apparatus at hydrant to permit No. 2 to step off rear running board with safety.

(2) No. 2 takes hydrant.

(3) No. 6 continues to fire with apparatus; removes ladders if needed.

(4) Officer orders amount of hose needed.

(5) No. 3 removes first fold of hose.

(6) No. 5 removes equipment.

(7) Nos. 4 and 3 continue removing hose, until sufficient amount has been removed.

(8) No. 3 disconnects coupling; hands male end to No. 4; replaces female end and slack hose in compartment; gives signal for No. 6 to return to hydrant.

(9) No. 4 obtains nozzle; connects to male end of hose; shuts nozzle off; leads-in.

(10) Nos. 3 and 5 line up on hose; assist No. 4 to lead-in; pull slack hose toward nozzle; lay hose down; advance and back-up No. 4 at nozzle.

(11) No. 6 spots pumper; makes connections.

(12) No. 2 assists No. 6; makes necessary connections and opens hydrant.

(13) No. 6 responsible for charging line when hose is in position at fire.

(14) No. 2 when released by No. 6, follows up line, removing kinks and tightening loose couplings; assists men at nozzle.

b. LAY-OUT No. 2. Fire to Hydrant—Single 2½-inch Line.

Ground Level.

(1) No. 6 stops apparatus at fire; removes ladder if needed.

(2) No. 5 removes equipment, then assists No. 2.

(3) Officer orders amount of hose needed.

(4) No. 3 removes first fold of hose; carries female end to rear running board on side toward fire, hands to No. 4.

(5) No. 2 continues removing hose; No. 5 assists if through removing equipment.

(6) No. 4 obtains nozzle with double male attached; connects to female end of hose; shuts nozzle off; leads-in.

(7) No. 3 lines up on hose; assists No. 4 to lead-in.

(8) No. 5 stands on hose when sufficient has been removed; gives signal for No. 6 to proceed.

(9) Nos. 6 and 2 proceeds to hydrant with apparatus.

(10) No. 5 gets off when sufficient has been laid to prevent drag; lines up on hose; assists No. 4 and 3 to lead-in.

(10) Nos. 3 and 5 pull slack hose toward nozzle; lay hose down; advance and back up No. 4 at nozzle.

(12) No. 6 spots apparatus at hydrant; makes hydrant connections.

(13) No. 2 removes sufficient hose to reach discharge gate of pump; disconnects coupling, replaces female end and slack hose in compartment; connects male end to discharge gate of pump, using a double female; assists No. 6.

(14) No. 2 opens hydrant.

(15) No. 6 responsible for charging line when connections are made.

(16) No. 2 when released by No. 6 follows up line, removing kinks and tightening loose couplings; assists men at nozzle.

c. LAY-OUT No. 3. Hydrant to Fire—Single 2½-inch Line—Reduced to wyed 1½-inch Lines.

Ground Level.

(1) No. 6 slows apparatus at hydrant to permit No. 2 to step off rear running board with safety.

(2) No. 2 takes hydrant.

(3) No. 6 continues to fire with apparatus; removes ladders if needed.

(4) Officer orders amount of hose needed.

(5) No. 3 removes first fold of hose.

(6) No. 5 removes equipment.

(7) Nos. 4 and 3 continue removing hose until sufficient amount has been removed.

(8) No. 3 disconnects coupling; hands male end to No. 4; replaces female end and slack hose in compartment; gives signal for No. 6 to return to hydrant when 1½-inch hose has been removed.

(9) No. 4 connects male end of hose to wye assembly; removes wye assembly and carries when leading in.

(10) No. 3 takes both 1½-inch nozzles; leads-in.

(11) No. 5 lines up on hose (center couplings of 1½-inch hose); assist No. 3 to lead-in; pull slack hose toward nozzle; lay hose down.

(12) No. 5 advances and takes one nozzle from No. 3.

(13) No. 4 opens shutoffs on wye; advances and backs up man at one nozzle.

(14) No. 6 returns to hydrant; spots apparatus; makes hydrant connections.

(15) No. 2 assists No. 6; make necessary connections and opens hydrant.

(16) No. 6 responsible for charging line when hose is in position at fire.

(17) No. 2, when released by No. 6, follows up line, removing and tightening loose couplings; backs up man at other nozzle.

d. LAY-OUT No. 4. Fire to Hydrant—Single 2½-inch Line—Reduced to Wyed 1½-inch Lines.

Ground Level.

(1) No. 6 stops apparatus at fire; removes ladders if needed.

(2) No. 5 removes equipment, then assists No. 2.

(3) Officer orders amount of hose needed.

(4) No. 3 removes first fold of hose; carries female end to rear running board on side toward fire, hands to No. 4.

(5) No. 2 continues removing hose; No. 5 assists if through removing equipment.

(6) No. 4 connects female end of hose to wye assembly and carries when leading-in.

(7) No. 3 takes both 1½-inch nozzles; leads-in, assisted by No. 4.

(8) No. 5 stands on hose when sufficient amount has been removed; gives signal for No. 6 to proceed when 1½-inch hose is clear of apparatus.

(9) Nos. 6 and 2 proceed to hydrant with apparatus.

(10) No. 5 gets off hose when sufficient amount has been laid to prevent drag; lines up on hose (center couplings of 1½-inch hose); assists No. 3 to lead-in; pull slack hose toward nozzle; lay hose down.

(11) No. 5 advances and takes one nozzle from No. 3.

(12 No. 4 opens shutoff on wye; advances and backs up man at one nozzle.

(12) No. 4 opens shutoffs on wye; advances makes hydrant connections.

(14) No. 2 removes sufficient hose to reach discharge gate of pump; disconnects coupling; replaces female end and slack hose in compartment; connects male end to discharge gate of pump, using a double female; assists No. 6.

(15) No. 2 opens hydrant.

(16) No. 6 responsible for charging line when connections are made.

(17) No. 2, when released by No. 6, follows up line, removing kinks and tightening loose couplings; backs up man at other nozzle.

e. LAY-OUT No. 5. Hydrant to Fire—Two 2½-inch Lines—Simultaneously.

Ground Level.

(1) No. 6 stops apparatus at hydrant.

(2) Men on rear running board disconnect coupling between compartments.

(3) No. 2 takes hydrant; gives signal for No. 6 to proceed.

(4) No. 6 proceeds to fire with apparatus; removes ladders if needed.

(5) Officer orders amount of hose needed.

(6) Nos. 3 and 4 remove hose from compartment on side toward fire.

(7) No. 5 and officer removes hose from other compartment.

(8) Nos. 3 and 5 disconnects couplings; hand male ends to No. 4 and officer; replace female ends and slack hose in compartments.

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(9) No. 4 and officer obtain nozzles; connect to male ends of hose; shut nozzles off; lead-in.

(10) No. 3 lines up on hose; assists No. 4 to lead-in; pull slack hose toward nozzle; advances and backs up No. 4 at nozzle.

(11) No. 5 gives signal for No. 6 to return to hydrant; lines up on hose; assists officer to lead-in; pull slack hose toward nozzle; advances and backs up officer at nozzle.

(12) No. 6 returns to hydrant; spots apparatus; makes hydrant connections.

(13) No. 2 assists No. 6; make necessary connections and opens hydrant.

(14) No. 6 responsible for charging lines when connections are made.

(15) No. 2, when released by No. 6, follow up lines, removing kinks and tightening loose couplings; relieves officer at nozzle.

(16) If conditions, strategy, etc., indicate that it is advisable, the second line may be disconnected immediately out of the compartment and a shutoff nozzle placed thereon. This may be extended if needed. (No. 5 to remove sufficient hose to extend this line before the pump returns to hydrant.)

f. LAY-OUT No. 6 "A". Hydrant to Fire—Single 2½-inch Line to Second Floor—Via Ladder and Fire Escape.

(1) Complete LAY-OUT No. 1 to base of ladder.

(2) No. 4 places nozzle on back with hose over shoulder; proceeds up ladder.

(3) Nos. 3 and 5 line up with hose over shoulder on same side as No. 4; follow up ladder.

(4) No. 4 gets on balcony; continues in window; places nozzle to one side; pulls in slack hose.

(5) No. 3 gets on balcony; remains near top of ladder.

(6) No. 5 locks-in at center of ladder.

(7) Upon signal from No. 3, Nos. 3 and 5, working in unison, pull hose for No. 4 until sufficient amount is in on second floor.

(8) No. 3 places hose over end of balcony to clear ladder; secures hose to balcony railing with hose strap.

(9) No. 4 takes nozzle; leads-in.

(10) Nos. 3 and 5 proceed in on second floor; backs up No. 4 at nozzle.

g. LAY-OUT No. 6—"B". Fire to Hydrant.

(1) Complete LAY-OUT No. 2 to base of ladder.

The operations are the same as when laying from hydrant to fire with the following exceptions:

(2) No. 5 proceeds to position after standing on hose.

h. LAY-OUT No. 6—"C". Lowering Line.

(1) Members assume original positions on fire escape, ladder and ground.

(2) When line is drained, all members lower in unison.

i. LAY-OUT No. 7—"A". Hydrant to Fire—Single 2½-inch Line—Reduced to wyed 1½-inch Lines to Second Floor, via Ladder and Fire Escape.

(1) Complete LAY-OUT No. 3 to base of ladder.

(2) No. 3 places both 1½-inch nozzles on back with hose over shoulder; proceeds up ladder.

(3) No. 5 lines up with hose over shoulder on same side as No. 3; follows up ladder.

(4) No. 4 places wye assembly on ground near base of ladder; places hose over shoulder; follows up ladder.

(5) No. 3 gets on balcony; continues in window; places nozzle to one side; pulls in slack hose.

(6) No. 5 gets on balcony; remains near top of ladder.

(7) No. 4 locks-in at center of ladder.

(8) Upon signal from No. 5, Nos. 5 and 4 pull hose for No. 3.

(9) When all slack 1½-inch hose has been passed up, No. 4 returns to ground; places hose over shoulder with wye assembly in front of body; proceeds to top of ladder.

(10) No. 5 takes wye assembly from No. 4; places wye assembly in window; remains on balcony.

(11) No. 4 locks-in on ladder.

(12) Nos. 5 and 4 continue to pull hose for No. 3 until sufficient amount is in on second floor.

(13) No. 3 takes nozzle; leads-in.

(14) No. 5 places hose over end of balcony to clear ladder; secures hose to balcony railing with hose strap; advances and takes one nozzle from No. 3.

(15) No. 4 proceeds to wye assembly; open(s) shutoff(s); advances and backs up man at one nozzle.

j. LAY-OUT No. 7—"B". Fire to Hydrant.

(1) Complete LAY-OUT No. 4 to base of ladder.

The operations are the same as when laying from hydrant to fire with the following exceptions:

(2) No. 3 proceeds up ladder with 1½-inch nozzles.

(3) No. 5 proceeds to position of No. 3 after standing on hose.

WHEN NOT NECESSARY TO TAKE WYE ASSEMBLY ALOFT.

No. 3 places 1½-inch hose over end of balcony to clear ladder. (No hose strap required on one-half inch hose.)

No. 4 returns to ground; opens shutoffs on wye assembly before proceeding in on second floor to back up man at nozzle.

k. LAY-OUT No. 7—"C". Lowering Line.

(1) Members assume original position on fire escape, ladder and ground.

(2) When line is drained, all members lower in unison.

l. LAY-OUT No. 8—"A". Hydrant to Fire—Single 2½-inch Line to Fire Floor via Ladders.

(1) Complete LAY-OUT No. 1 to base of ladder.

(2) No. 4 places nozzle on back with hose over shoulder; proceeds up ladder.

(3) Nos. 3 and 5 line up with hose over shoulder on same side as No. 4; follow up ladder.

(4) No. 4 continues in fire floor window; lays nozzle to one side; pulls in slack hose.

(5) No. 3 (if not needed on ladder) on direction of No. 4 continues in fourth floor window; picks up nozzle and proceeds to fire.

(6) No. 4 remains at window and directs No. 5 (also No. 3 if needed) to lock-in on ladder when properly spaced.

(7) Upon signal from No. 4, all men working in unison, pull hose.

(8) When sufficient hose is in on fire floor, men place hose on rungs of ladder next to beam; secure hose to ladder with hose strap.

(9) No. 4 places hose on window sill to clear top of ladder; proceeds in on fire floor.

(10) Men on ladder unlock; proceed in on fire floor; back up man at nozzle.

(11) Men on ladder should be from 12 to 18 feet apart when pulling hose.

m. LAY-OUT No. 8—"B". Fire to Hydrant.

(1) Complete LAY-OUT No. 2 to base of ladder.

The operations are the same as when laying from hydrant to fire with the following exceptions:

(2) No. 5 proceeds to position after standing on hose.

n. LAY-OUT No. 8—"C". Lowering Line.

(1) Members return to original position.

(2) When line is drained, allow hose to slide down ladder until all slack is down.

(3) Man at top of ladder has nozzle placed over shoulder by No. 4; all men proceed down ladder in unison.

o. LAY-OUT No. 9—"A". Hydrant to Fire—Single 2½-inch Line to Fifth Floor via Ladder and Fire Escape.

(1) Complete LAY-OUT No. 1 to base of ladder.

(2) No. 4 places nozzle on back with hose over shoulder on side which will be next to building when climbing fire escape; proceeds up ladder and fire escape.

(3) Nos. 3 and 5, and officer line up with hose over shoulder on same side as No. 4; follow up ladder and fire escape.

(4) No. 4 goes under guard rail of each balcony and places nozzle in window of fifth floor; remains on balcony.

(5) Nos. 3, 5 and officer stop on balconies; No. 3 at fourth floor; No. 5 at third floor; officer at second floor.

(6) Upon signal from No. 4, all men working in unison pull hose until sufficient amount is on fifth floor.

(7) Nos. 4, 3 and 5 secure hose to guard rails with hose strap; officer places hose over end of balcony to clear ladder.

(8) No. 4 takes nozzle; leads-in.

(9) Other men proceed to fifth floor; Nos. 3 and 5 back up No. 4 at nozzle.

p. LAY-OUT No. 9—"B". Fire to Hydrant.

(1) Complete LAY-OUT No. 2 to base of ladder.

The operations are the same as when laying from hydrant to fire with the following exception:

(2) No. 5 proceeds to position after standing on hose.

q. LAY-OUT No. 9—"C". Lowering Line.

(1) Members assume original positions on fire escape balconies.

(2) When line is drained, all members descend fire escape in unison, carrying hose.

r. LAY-OUT No. 10—"A". Connecting to Standpipe Outlet on Fire Floor—Two 2½-inch Lines Into Standpipe; Hose Packs to Upper Floor, via Ladder and Fire Escape.

(1) Complete LAY-OUT No. 5 until hose is removed.

(2) Nos. 3 and 5 take hose packs; proceed up ladder and fire escape to balcony at fire floor.

(3) No. 4 and officer disconnect couplings; replace female ends and slack hose in compartment; obtain nozzles; connect to male ends of hose; shut nozzles off; lead-in to standpipe; remove nozzle tips; connect to standpipe inlets (spanner tight); open shutoffs.

(4) Nos. 3 and 5 remove hose packs on balcony at fire floor.

(5) No. 3 opens pack; places nozzle inside window; passes female end of hose around outer edge of balcony to No. 5; provide slack hose to reach standpipe outlet; secure hose to balcony railing with hose strap (assists to extend line if necessary).

(6) No. 5 connects female end of hose to standpipe outlet, keeping hose around outer edge of balcony; secures hose to balcony railing with hose strap (assists to extend line if necessary); opens gate valve when nozzle is in position.

(7) No. 4 and officer proceed to fire floor; No. 4 takes nozzle; leads-in (no. 4 will take third hose pack aloft if needed and officer will lead-in with nozzle.)

(8) Nos. 3 and 5 advance and back up No. 4 at nozzle.

s. LAY-OUT No. 10—"B". Connecting to Standpipe Outlets on Floor Below Fire.

The operations are the same as when connecting to outlets on fire floor with the following exceptions:

(1) No. 5 stops on balcony at floor below fire.

(2) No. 3 lowers female end of hose over balcony railing to No. 5; secures with hose strap.

(3) No. 5 connects to standpipe outlet on floor below fire.

(4) No. 5 does not secure hose to balcony railing.

t. LAY-OUT No. 10—"C". Lowering Lines.

(1) Members assure equal spacing on fire escape balconies.

(2) When line is drained, slack hose is lowered; members then descend fire escape in unison carrying hose.

(3) Female coupling of last section aloft is connected to second floor standpipe outlet; nozzle is lowered to ground and standpipe is drained (street connection can be drained by opening clapper valve with spanner).

u. LAY-OUT No. 11—"A". Connecting to standpipe outlet on Fire Floor—Two 2½-inch Lines into Standpipe—Single 2½-inch Line to Fire Floor via Ladder and Fire Escape.

(1) Complete LAY-OUT No. 5 until couplings are disconnected.

(2) No. 4 and officer obtain nozzles; connect to standpipe inlets (spanner tight); open lead-in to standpipe; remove nozzle tips; connect to standpipe inlets (spanner tight); open shutoffs.

(3) Nos. 5 and 3 remove hose needed aloft from compartment on side away from fire.

(4) No. 5 disconnects coupling; hands male end to No. 3; replaces female end and slack hose in compartment.

(5) No. 3 obtains nozzle; connects to male end of hose; shuts nozzle off; places nozzle on back with hose over shoulder that will be next to building when climbing fire escape; proceeds up ladder and fire escape.

(6) Nos. 5, 4 and officer line up with hose over shoulder on same side as No. 3; follow up ladder and fire escape.

(7) No. 3 continues to fire floor balcony; goes under guard rail; places nozzle in window; remains on balcony.

(8) Nos. 5, 4 and officer stop on proper balcony to provide best team work.

(9) Upon signal from No. 3, all men, working in unison, pull hose until female coupling passes them; proceed to fire floor.

(10) No. 3 passes female end of hose around outer edge of balcony to No. 5; pro-

vides slack hose to reach standpipe outlet; secures hose to balcony railing with hose strap.

(11) No. 5 connects female end of hose to standpipe outlet, keeping hose around outer edge of balcony; secure hose to balcony with hose strap; opens gate valve when nozzle is in position.

(12) No. 4 proceeds to nozzle; leads-in.

(13) Nos. 3 and 5 advance and back-up No. 4 at nozzle.

v. LAY-OUT No. 11—"B". Connecting to Standpipe Outlet on Floor Below Fire.

The operations are the same as when connecting to outlets on fire floor with the following exceptions:

(1) No. 5 remains on balcony at floor below fire when hose is pulled up.

(2) When female coupling reaches floor below fire, No. 5 connects to standpipe outlet.

(3) No. 5 does not secure hose to balcony railing.

(4) No. 3 secures hose to guard railing on fire floor.

w. LAY-OUT No. 11—"C". Lowering Line.

(1) Members assume original positions on fire escape balconies.

(2) When line is drained, slack hose is lowered; members then descend fire escape in unison carrying hose.

(3) Female coupling of last section aloft is connected to second floor standpipe outlet; nozzle is lowered to ground and standpipe is drained (street connection can be drained by opening clapper valve with spanner).

Chapter 6

FIRE FIGHTING EQUIPMENT AND ITS USE (cont.)

Ladders

0601. LADDERS—GENERAL DATA

NOTE:

A. The distribution requirements for ladder trucks are set forth in OPNAV Instruction 5560.2; under these standards ladder trucks are not necessary at most naval activities.

B. The instructions set forth herein relating to certain phases of ladder operations e. g., carrying, raising, etc., are mainly applicable to wood ladders, and therefore appropriate modifications may be made by activities utilizing metal ladders.

1. Definitions

Base—Butt

The bottom end of a ladder.

Beams

The principal structural members of ladders.

Braces

Strips running diagonally from beams to trusses, between truss blocks.

Dog—Lock-Pawl

Device which locks the "fly" ladder in position.

Guides

Strips on inner side of truss blocks and on beams between rungs, which guide the "fly" ladder.

Halyard

Rope or cable used to extend the "fly" and "center" ladders.

Ladders

Straight—A ladder built in one section.

Extension—A ladder built in two or more sections.

Main—The lowest section of an extension ladder.

Center—The center section of an extension ladder.

Fly—The upper section of an extension ladder.

Poles—Tormentors

Poles, detachable or permanently attached to the upper end of the main ladder of some extension ladders, used to raise, guide and brace these ladders.

Poles—"U"

Poles, equipped with **"U"** shaped metal devices, used to brace 35-foot straight ladders.

Pulley

Grooved wheel over which the halyard is drawn when extending "fly" ladder.

Rollers

Rollers, at top of main ladder on manually operated aerial ladders, over which the "fly" rolls.

Rungs

Cross members of ladders, used when climbing.

Shoes

Metal devices at base of ladder.

Spurs

Metal device at butt of poles.

Stops

Devices which prevent extending the "fly" out of main ladder.

Tie-Rods

Rods which hold the ladder assembly together.

Truss

The under strip of a beam on a trussed ladder.

Truss-Blocks

Blocks between the beams and trusses of a trussed ladder.

2. Uses

(a) Climbing.

(b) Ventilating.

(c) Improvising straight ladders from extension ladders.

(d) Improvising step ladders.

(e) Constructing drains.

(f) Bracing other ladders.

(g) Bridging between buildings.

(h) Improvising extension ladders.

(i) Improvising battering rams.

3. Number of Men Permitted on Ladders

(a) 10, 14, 16 feet, one man.

(b) 20, 24 feet, two men.

(c) 30, 35 feet, three men.

(d) 50 feet, four men.

(e) 75, 80 feet, five men.

(f) 100 feet, eight men properly spaced when top of ladder is supported. Three men properly spaced when top of ladder is not supported. Two men is the limit on the "fly."

(7) Roof ladders on pitched roofs, two men.

4. Marking

Marking the length on beam at both ends eliminates guess work when removing or replacing ladders.

5. Inspecting

Ladders should be inspected periodically and after use.

a. Check for

(1) Marred, worn, cracked or splintered parts.

(2) Shoes and spurs worn smooth.

(3) Worn, frayed or loose halyards.

(4) Loose tie-rods, truss-rods, turnbuckles and beam bolts.

b. Care of Wood Ladders

(1) Keep ladders clean and dry.

(2) Oil pawls and pulleys as needed.

(3) Replace, repair or adjust worn, frayed or loose halyards.

(4) Sharpen dull shoes and spurs.

(5) Report loose or broken truss-rods, tie-rods, turnbuckles and beam bolts. REPAIRS OF THIS NATURE ARE TO BE MADE ONLY BY QUALIFIED PERSONNEL.

(6) When necessary, ladders of wood construction should be scraped, lightly sanded, and two coats of varnish applied. Varnishing is considered a means of preserving the wood and facilitates inspection.

c. Care of Metal Ladders

(1) Aluminum ladders should be given the same care in handling and use that is advocated for wood ladders. They should be examined for alignment of beams, twists or bends; loose rungs; dents or damage to rails or rungs; cracks or splits; loose rungs; loose or sheared rivets, and any deterioration in the channels and "T" sections where openings in the metal may permit accumulations of foreign matter and moisture.

(2) Where the rungs of metal ladders are covered with rubber or other insulation these "grips" should be tight and free of foreign material that may cause injury to the hands.

(3) Metal ladders may be coated with proper aluminum paint or any other coating recommended by the manufacturer.

0602. LADDERS—Basic Operations

1. REMOVING

Several methods are employed for carrying ladders on apparatus. They may be held in place by ladder locks, keys, straps, etc. Removing or unlocking these devices is necessary to release the ladders.

The tiller post must be withdrawn on some trucks before certain ladders can be removed.

2. CARRYING

Roof (Hook)—One Man

Hook forward; rungs next to body; top or bottom beam on shoulder (fig. 142).

Figure 142.

Carrying—16- and 20-foot Straight, One Man

Rungs next to body; arm through ladder at center; top beam on shoulder (fig. 143).

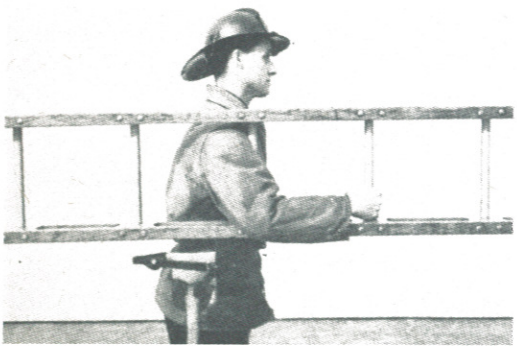

Figure 143.

20- and 24-foot Straight, Two Men

Rungs next to body; arms through ladder near butt and top; hands forward so arms bind rungs; weight supported at arms length (fig. 144).

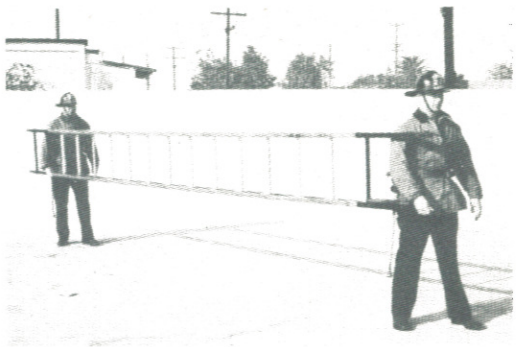

Figure 144.

30- and 35-Foot Straight, Four Men

Carried flat; rungs down; each man grasps beam near end; weight supported at arm length (fig. 145).

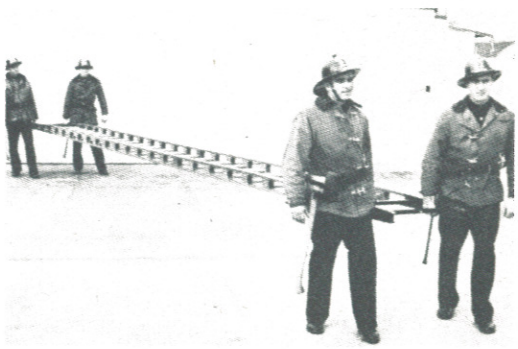

Figure 145.

Carrying—14- and 20-Foot Extension, One Man

Butt forward; rungs next to face; lower beam on shoulder (fig. 146).

Figure 146.

35-Foot Extension (on edge), Three Men

Base and top men near ends of ladder; center man approximately one-third distance from top; rungs next to body; arms through ladder; hands gripping lower beam; weight supported by arms (fig. 147).

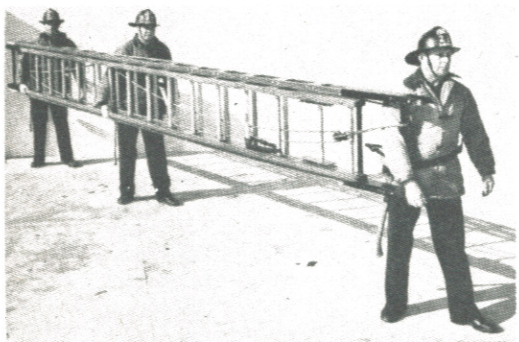

Figure 147.

35-Foot Extension (Flat), Three Men

Base man near butt; top men approximately one-third distance from top on opposite sides of ladder; rungs down; beams on inside shoulders (fig. 148).

Figure 148.

Carrying—50-Foot Extension (Bangor), Six Men

Carried flat; rungs down; three men evenly spaced on each side; beams on inside shoulders (fig. 149).

Figure 149.

3. PLACING

To determine the distance the butt of a ladder should be spotted from a building or object, to obtain the proper climbing angle, divide the length of the ladder by 5 and add 2.

Ladders are generally placed to the left side of windows to facilitate getting on or off. Ladders placed for climbing are to have rungs facing out with butt resting evenly.

Avoid unnecessary blocking of doors, passageways, etc.

4. FOOTING

One Man

Place the ball of each foot well up on end of beam, with heels resting firmly on ground; grasp beams after ladder is raised slightly, allowing the body to hang back to maintain balance (fig. 150).

Figure 150.

Footing on Beam

Place ball of foot well up on end of beam; reach down and assist man raising (fig. 151).

Figure 151.

Footing, Two Men

Each man places ball of outside foot well up on end of beam; allow heels to rest firmly on ground; grasp beam with outside hand and rung with inside hand after ladder is raised slightly, allowing body to hang back to maintain balance (fig. 152).

Figure 152.

Ladder in Vertical Position, Footing

Each man places ball of outside foot well up on end of beam, allowing heels to rest firmly on ground; steady ladder with inside hands on rungs, outside hands on beams (fig. 153). (On extension ladders, when the fly is extended span the beams.)

Figure 153.

Footing (Lowering-in), One Man

Place one foot on bottom rung; grasp beams with hands; use weight of body to prevent base of ladder sliding out (fig. 154).

Figure 154.

Footing (Lowering-in), Two Men

Each man places ball of outside foot well up on beam, allowing heel to rest firmly on ground; grasps rung with inside hand and beam with outside hand (on extension ladders, when fly is raised, span the beams); exert pressure on beam with foot to prevent base sliding out (fig. 155).

Figure 155.

5. RAISING

Ladders are generally raised parallel with the building or object against which they are to be placed, however, where overhead wires or other obstructions are encountered, it may be necessary to raise them at an angle to the building or object.

Preparatory to raising trussed ladders, turn ladders, RUNGS DOWN.

When one man raises ladder, grasp center of rungs.

When two men raise ladder, grasp beams with outside hands, rungs with inside hands; work in unison.

Extension ladders should be extended to approximately 1 foot above window sills or fire escape balcony railings and approximately 3 feet above fire-walls, roofs, etc.

DO NOT reach through rungs to lock fly of extension ladders.

When locking fly of one-man ladders, pull up on halyard from front side; on other ladders pull down on halyard from back side.

6. PIVOTING

The term "pivoting" as applied to ladders, means the turning of a ladder on one of its beams when the ladder is in a vertical or near vertical position.

a. Method (A): Raising 20- and 24-foot straight and 35-foot extension ladders.

Base man alone foots pivoting beam, starts pivot just before ladder reaches vertical position, and lowers ladder into position (fig. 156).

b. Method (B): Raising 30- and 35-foot straight and 50-foot Bangor ladders:

Figure 156.

Because of weight and length, pivoting beam is footed from front and rear positions, and rotated into position only when vertical position is reached (fig. 157).

Figure 157.

NOTE.—Pivot on beam nearest building or object against which ladder will rest.

Make sure rungs are out when pivot is completed.

Watch top of ladder to avoid overhead obstructions.

7. CLIMBING

In ascending or descending, face the ladder; climb near center, with hands grasping the rungs, shoulders approximately an arm's length from the ladder (fig. 158).

Figure 158.

8. LOCKING-IN

For efficient work, it is necessary to "lock-in" when working from a ladder to permit the free use of both hands. Lock-in on the side opposite that on which the work is to be performed.

(a) Climb ladder to desired height.

(b) Place one leg through ladder over the second or most convenient rung above the one on which you stand.

(c) Bring foot back through ladder under rung; hook foot on beam (fig. 159).

Figure 159.

9. SECURING

Ladders raised to fire escape balconies should be secured to balcony railing with ladder strap; whenever possible place strap so as to include balcony railing, beam and nearest rung of ladder. Whenever possible get on balcony, inside window, or on roof to strap ladders. Ladders shall be held or footed, while in use, until they are strapped.

Ladders raised to windows may be secured by strapping rung to a pole, bar, or other similar object placed horizontally just inside the window. On roofs hay hook and strap may be used.

When it is not possible to secure ladders the base shall be made safe against slippage while men are climbing or working on them.

10. SHIFTING

One Man

Bring ladder to vertical position; with hands well apart, grasp centers of most convenient rungs; watch top; lift ladder; balance; carry (fig. 160).

Figure 160.

Two Men

Two men on same side, bring ladder to vertical position; with inside hands, grasp most convenient common rung, palms up; with outside hands, reach up, grasp beams; watch top; lift ladder; balance; carry (fig. 161).

Figure 161.

Four Men

Two men on each side, bring ladder to vertical position; with inside hands, grasp most convenient common rung, palms up; with outside hands, reach up, grasp beams; watch top; lift ladder; balance; carry (fig. 162).

Figure 162.

If ladder becomes unbalanced while shifting, ground it immediately and place foot on bottom rung to steady ladder while regaining control.

11. BRACING

U Poles are used to brace 35-foot straight ladders (fig. 163). (Butt of poles should not be forced into position.)

Figure 163.

12. LOWERING

In general, the operations necessary to lower ladders are the reverse of those used in raising.

13. VENTILATING

Ladders may be used to advantage in ventilating above ground where window panes are encountered. With the ladder held in position some distance away, allow the top to fall against glass.

14. BATTERING

The use of ladders as battering rams is not recommended; however, in an emergency where a life hazard exists and regular battering tools are not available, ladders may be used.

LADDERS

OPERATIONS

0603. LADDERS—EVOLUTIONS

1. Roof (Hook)

Roof ladders, with collapsible hooks, are 10, 12, and 14 feet in length. They are used for climbing and working on pitched roofs to distribute weight and to avoid slipping; for descending into holes, or wherever it is necessary to have a ladder supported at the top instead of the foot. They are generally used in conjunction with another ladder.

(a) Carry to desired location, hooks to front and unopened; rungs next to body; top beam on shoulder.

(b) Place foot against base of climbing ladder. Open hooks toward straight side of ladder (fig. 164). Place base of roof ladder against base of ladder set for climbing (fig. 165). Proceed up climbing ladder, place arm between 2d and 3d rungs. Balance ladder on shoulder and climb using both hands.

NOTE.—When not using hooks use a straight ladder. For safety do not open hooks until climbing ladder is reached.

2. 16- or 20-Foot Straight One Man

Sixteen- and 20-foot straight ladders are generally used for reaching roofs of sheds, windows on second floors, etc., and can sometimes be used to reach the lowest fire escape balcony.

(a) Carry to desired location.

(b) Place butt of ladder against building or object; grasp top beam with free hand; grasp lower beam with other hand; turn ladder rungs down (fig. 166).

Figure 164.

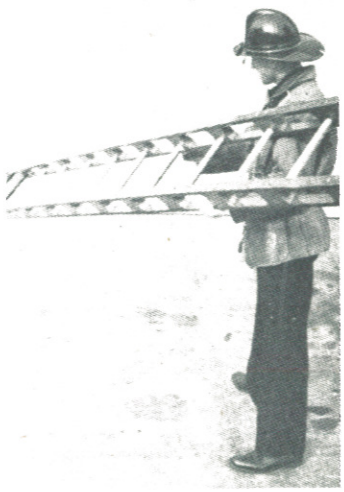

Figure 165.

Figure 166.

(c) Raise ladder to vertical position with hand grasping center of most convenient rungs.

(d) With hands well apart, grasp center of most convenient rungs; lift ladder clear of ground; adjust to proper climbing angle.

(e) Secure ladder if possible.

3. 20- or 24-Foot Straight (on beam), Two Men

Twenty and 24-foot straight ladders are used for reaching roofs of 1-story buildings, windows on second floors, fire escape balconies, etc.

(a) Carry to desired location.

(b) Base man spots butt of ladder below objective, proper distance out; places beam on ground and foots ladder on truss side (fig. 168).

(c) Top man grasps top beam with free hand, raises ladder using lower beam and walking toward base of ladder (figs. 166 and 167).

Figure 167.

(d) Base man assists in raising by reaching down, grasping top beam, and pulling upward.

(e) When ladder reaches a near-vertical position, both men pivot ladder, if necessary, front man places foot on bottom rung, both men lower ladder to objective.

(f) Front man secures ladder if possible.

4. 20- or 24-Foot Straight, Two Men

(a) Carry to desired location.

(b) Base man spots butt of ladder below objective, proper distance out; turns ladder, rungs down; foots ladder.

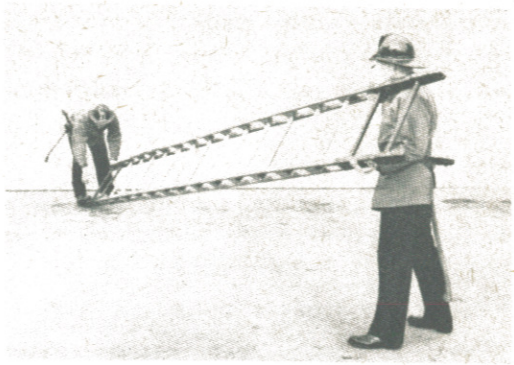

Figure 168.

(c) Top man grasps top beam with free hand; grasps nearest rung with other hand; assists base man to turn ladder (fig. 168); raises ladder with hands grasping center of most convenient rungs.

(d) When ladder reaches a near-vertical position, both men pivot ladder, (BASE MAN KEEPS FOOT SECURELY AGAINST INSIDE BEAM).

(e) Front man places foot on bottom rung; both men grasp beams; rear man steps back; both men lower ladder in to objective.

(f) Front man secures ladder if possible.

5. 30- or 35-Foot Straight, Four Men

Thirty and 35-foot straight ladders are used for reaching third floor windows, roofs of two story buildings, etc. "U" Poles are used to brace 35-foot straight ladders.

(a) Carry to desired location.

(b) Base men spot butt of ladder below objective, proper distance out; foot ladder.

(c) Top men grasp truss of ladder with free hands; swing bodies under ladder; raise ladder with outside hands on beams, inside hands on rungs, working in unison (fig. 169).

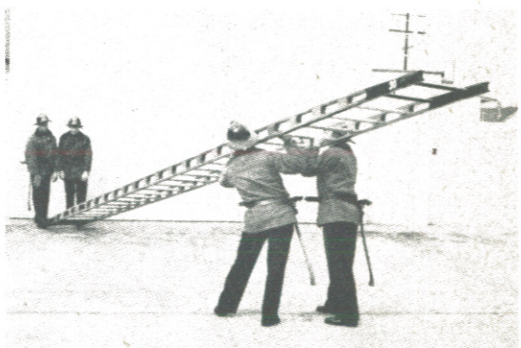

Figure 169.

(d) When ladder reaches a near-vertical position, all men pivot ladder, (BASE MAN FOOTING INSIDE BEAM KEEPS FOOT SECURELY AGAINST BEAM), other base man steps back.

(e) Front men foot ladder with outside feet; all men grasp rungs and beams; rear men step back; all men lower ladder into objective.

(f) Right front man secures ladder if possible.

(g) Rear men place "U" Poles when 35 foot straight ladder is raised.

6. 14-Foot Extension, One Man

Fourteen foot extension ladders are very useful for inside work. They can be taken up stairways, used to remove scuttle hole covers, open ceilings, made into step ladders, etc. These ladders are made in two 9-foot sections. A short pike pole is usually carried strapped to the fly.

(a) Carry to desired location.

(b) Stand ladder in upright position; steady ladder by grasping beam of main ladder and hooking foot around front of same beam at ground (fig. 170).

Figure 170.

(c) Reach down back of ladder; grasp bottom rung of fly; raise fly to desired height, (fig. 170); hook dogs over rung of main ladder.

(d) Lower ladder into objective.

7. 14-Foot Extension, Improvising a Step Ladder

(a) Lay ladder on ground, rungs down; remove pike pole.

(b) Push fly forward slightly to release dogs; lift fly at base; pull back to release fly from guides.

(c) Turn fly end for end, with rungs up (not necessary on some ladders); insert base of fly into upper end of main ladder by reaching down between rungs of fly and lifting main ladder slightly; hook dogs on upper rung of main ladder.

(d) Strap two upper rungs together; raise ladder to desired position; attach hose strap to rung of main ladder and hook on rung of fly to prevent spreading (fig. 171).

Figure 171.

8. 20-Foot Extension, One Man

Twenty-foot extension ladders are generally used to reach roofs of sheds, second floor windows, etc., and occasionally the lowest fire escape balconies. These ladders are made in two 12-foot sections and some types can be taken apart to make 2 straight ladders.

(a) Carry to desired location.

(b) Bend forward; rest butt of ladder on ground; raise ladder to a vertical position.

(c) Step in front of ladder; steady ladder by hooking foot around beam with knee against front of beam (fig. 172).

(d) Allow top of ladder to lean toward objective to counteract strain created by pulling on halyard.

Figure 172.

(e) Raise extension to desired height; pull up on halyard to lock fly.

(f) With one hand grasping each beam and one foot on bottom rung, lower ladder into objective.

(g) Secure ladder.

9. 35-Foot Extension, Three Men

Thirty-five-foot extension ladders are used to reach fire escape balconies, roofs of 2 and some 3 story buildings, second and third floor windows, etc. These ladders are made in two 20-foot sections.

10. 35-Foot Extension Carried on Edge

(a) Carry to desired location.

(b) Base man spots butt of ladder below objective, proper distance out; turns ladder, rungs down (fig. 173); foots ladder.

(c) Center man grasps top beam with free hand; grasps nearest rung with other hand; assists base man to turn ladder; places beam on shoulder (fig. 173).

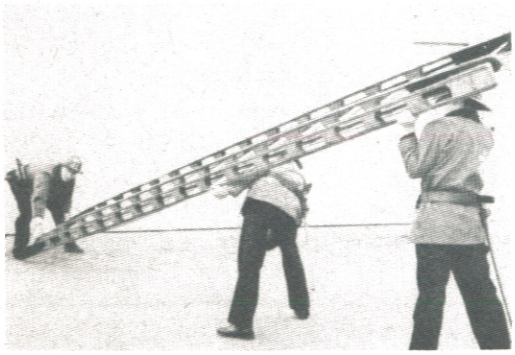

Figure 173.

(d) Top man assists other men to turn ladder (fig. 173); moves to opposite side even with centerman (fig. 174); grasps beam.

(e) Top and center men, working in unison, raise ladder with outside hands on beams, inside hands on rungs.

(f) When ladder reaches a near-vertical position, all men pivot ladder (BASE MAN KEEPS FOOT SECURELY AGAINST BEAM.)

(g) All men foot ladder; allow ladder to lean slightly to counteract strain created by pulling on halyard.

(h) Front man, right side, raises fly; other men span beams to steady ladder.

(i) Rear man pulls down on halyard to lock fly.

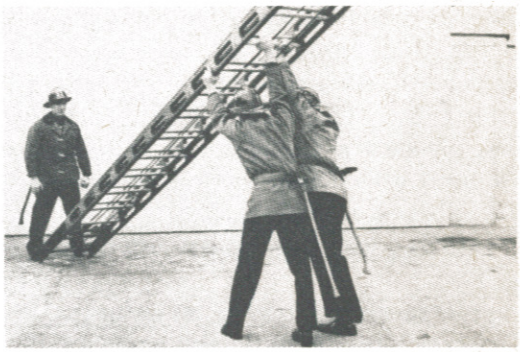

Figure 174.

(j) Front men continue to foot ladder; rear man steps back; all men lower ladder in to objective.

(k) Front man, right side, secures ladder.

11. 35-Foot Extension—Three Men, Carried Flat

(a) Carry to desired location.

(b) Base man spots butt of ladder below objective; proper distance out; foots ladder.

(c) Top men, working in unison, raise ladder with outside hands on beams, inside hands on rungs.

(d) When ladder reaches a near-vertical position, all men pivot ladder (BASE MAN KEEPS FOOT SECURELY AGAINST INSIDE BEAM).

(e) All men foot ladder; allow ladder to lean slightly to counteract strain created by pulling on halyard.

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(f) Front man, right side, raises fly; other men span beams to steady ladder.

(g) Rear man pulls down on halyard to lock fly.

(h) Front men continue to foot ladder; rear man steps back; all men lower ladder in to objective.

(i) Front man, right side, secures ladder.

12. 50-Foot Extension (Bangor), Six Men

Fifty-foot extension ladders are used to reach roofs of 3 and some 4 story buildings, third and fourth floor windows, etc. These ladders are made in two 28-foot sections and are provided with tormentor poles to assist in raising and to brace ladder.

(a) Carry to desired location (fig. 149).

(b) Base men spot butt of ladder below objective, proper distance out.

(c) All men grasp truss or fly with free hands; turn bodies; lower ladder to ground.

(d) Base men release tormentor poles; pass poles to center men who in turn pass poles to top men. (On ladders having detachable poles, top men grasp butt end of poles, walk back until center men can secure top end of poles to beams of main ladder.)

(e) Base men foot ladder with outside feet (fig. 175).

(f) Center men take positions near swivels of poles; face top of ladder (fig. 175).

(g) Top men grasp butt of poles with right hands, spurs between fingers; grasp poles at

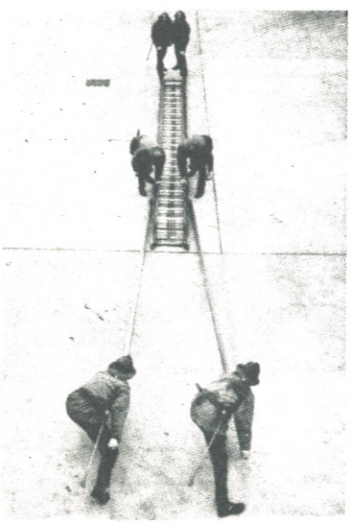

Figure 175.

Figure 176.

arms length with other hands; step out approximately 1 foot from in-line with beams (fig. 175).

(h) Upon signal from base men, center men grasp truss of fly with inside hands; raise ladder, turning bodies to face base; grasp nearest rung with free hands; continue raising ladder with outside hands on beams, inside hands on rungs, working in unison.

(i) When ladder has been raised sufficiently, pole men exert upward pressure, assisting to raise ladder to a vertical position.

(j) When ladder reaches a vertical position, men at base foot ladder with outside feet; span beams to steady ladder (fig. 176).

(k) Pole man farthest from building carries pole around to side of ladder at right angles to other pole (fig. 176); pushes slightly to shift weight of ladder to inside beam.

(l) Men at base, front and rear, foot inside beam; pivot ladder rungs out; foot ladder with outside feet.

(m) Rear man, right side, spans beams. Front men raise fly (when retracting fly, front man, right side, handles halyard).

Rear man, left side, pulls slack halyard through to rear of ladder while fly is being extended.

(n) When fly is extended to desired position, rear man, right side, pulls down on halyard to lock fly.

(o) Pole man, nearest building, carries pole around to front of ladder, both pole men step out one step from in-line with beams.

(p) Rear man, left side, secures halyard to most convenient rung as ladder is lowered-in.

(q) Other men lower ladder in to objective.

(r) Pole men place poles in toward building at approximately a 45° angle from point where they are attached, to brace ladder (do not force poles into position).

13. Hoisting

Situations may arise where it becomes necessary to hoist ladders to roofs or upper floors of buildings. A rope and hose roller are generally used for this purpose.

14. Hoisting to Roof

(a) Two or more men obtain hose roller and rope; proceed to roof; secure hose roller to edge of roof; lower rope; place rope over hose roller.

(b) Men on ground lay ladder in position to be hoisted; secure rope to ladder.

(c) Men on roof hoist ladder (man on ground turns ladder so rope will be between ladder and building). (When lowering, ladder should be between rope and building.)

(d) When top of ladder is slightly above hose roller, man on roof passes bight of slack rope between first and second rungs and hooks bight over end of beam; allows loop to lengthen as ladder is hoisted.

(e) Continue to hoist ladder; when ladder knot reaches hose roller, man with loop breaks ladder over hose roller.

(f) Other men turn ladder on edge; pull in on roof.

15. Hoisting to Upper Floors

(a) Two or more men obtain hose roller and rope; proceed to the roof or a floor above where ladder is desired; secure hose roller to edge of roof or window sill; lower rope, place rope over hose roller.

(b) One or more men proceed to window of floor on which ladder is desired.

(c) Men on ground lay ladder in position to be hoisted; secure rope to ladder.

(d) Men on roof, or upper floor, hoist ladder until base is even with desired window (man on ground turns ladder so rope will be between ladder and building). (When lowering, ladder should be between rope and building.)

(e) Man at window pulls base of ladder in as men above lower slowly.

16. Bridging

Emergencies may arise where it is necessary to bridge between buildings to effectively carry on operations.

Straight ladders only should be used for this purpose.

(a) Two or more men obtain hose roller and rope; proceed to the roof or a floor above the one from which ladder is to be extended; secure hose roller to edge of roof or to window sill; lower rope; place rope over hose roller.

(b) Two or more men proceed to window of floor from which ladder is to be extended.

(c) Men on ground lay ladder in position to be hoisted; secure rope to ladder.

(d) Men on roof, or upper floor, hoist ladder until base is even with desired window, (man on ground turns ladder so rope will be between ladder and building).

(e) Men at window grasp base of ladder; signal men aloft to lower; pull base in window as ladder is lowered.

(f) When ladder nears horizontal position, men at base shove ladder toward opposite window.

(g) When ladder comes to rest on opposite window sill, men at base turn ladder, truss down.

(h) Men above take tension on and secure rope.

17. Alternate Method of Bridging

Operations are the same as above with the following exceptions:

(a) Men at window grasp base of ladder; turn ladder between rope and building; signal men aloft to lower; pull base in window as ladder is lowered.

(b) When ladder comes to rest on opposite window sill, men above take tension on and secure rope.

0604. LADDERS—TESTING

1. General Data.

a. The following procedures are for the guidance of naval fire departments in the testing of ladders.

b. In considering the following data, several characteristics must be taken into consideration; are the ladders standard dimensions; to what use have they been subjected; have they been repaired, age of ladder, etc.

c. These facts have a bearing on the severity of the tests to which they should be subjected, but, it must be remembered that ladders whether old or new, weak or strong, may be subject to the same stress in an emergency. In view of this, it must be conceded that a ladder, if unable to withstand a fair test, should be surveyed. The prime purpose of testing ladders is to ascertain which ones are unfit for further use.

d. Submitting a ladder to no more than the stress it might receive in ordinary usage is not considered satisfactory. The strength of a ladder decreases with time and usage, and if a ladder is just strong enough to meet ordinary usage at the time when it is tested, it is possible that natural weakening between testing periods might be sufficient to cause collapse of the ladder in service during that period.

e. It is for this reason ladders should be expected to carry safely more weight in test than they would when in ordinary fire service.

f. A safe practice is to take the weight of the number of men permitted on the particular ladder (Art. 0601, Par. 3, Number Permitted) and test to twice this weight, not making any allowance for the weight of hose. The load should be evenly distributed along the ladder in units of 175 pounds, the estimated weight of the average man.

g. The most satisfactory method of applying the load, and one which does not entail any danger to personnel conducting the test, is illustrated throughout the following instructions.

h. Prior to setting the ladder up for test, the following items should be checked:

(1) Make certain that each rung is tight.

(2) Inspect each beam, truss, rung and truss block (chair) for checks, cracks, evidences of weakness or any other discrepancies.

(3) Inspect each tie rod for tightness, and if an extension ladder, check the guides, stops and halyard pulley for rigidity.

i. This inspection should disclose any wavy or wrinkled condition of the grain of the wood. If not detected, but suspected, a thorough examination should be conducted to prove otherwise.

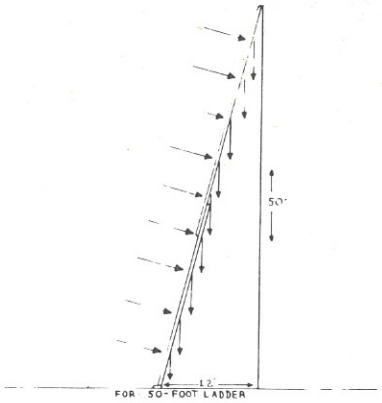

Figure 177.

j. When the ladder proves satisfactory in these respects, the test can be carried further. The first step is to place the ladder in position at the proper angle (fig. 177).

k. The formula for determining the distance for placing the base of the ladder out from the building when testing, is—divide the length of ladder or the portion of the ladder extended by five (5) then add two (2) (Length÷5+2= Distance). Example: (a thirty-five- (35) foot ladder fully extended would be:

$$35 \div 5 = 7 + 2 = 9 \text{ feet}).$$

2. Applying the Test Load.

Obtain the required number of sandbags, pulleys, rungclips and rope (each sandbag—87 pounds).

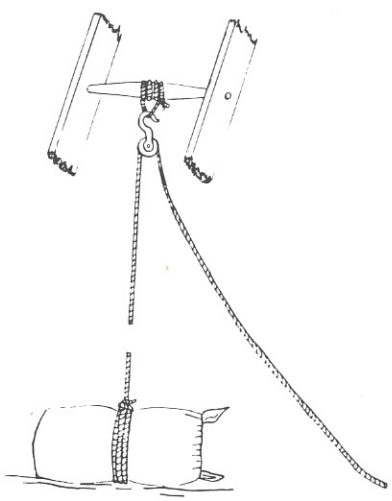
Figure 178.

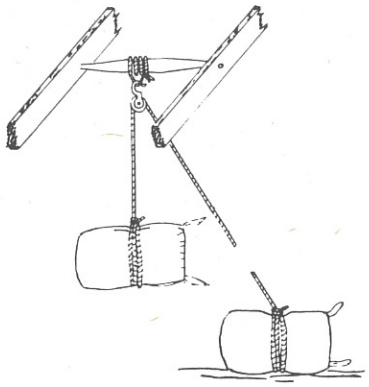

Figure 179.

a. Through each pulley is reeved a piece of sash cord or quarter (¼) inch diameter rope of sufficient length for both ends to reach the ground.

b. One end of the sash cord or rope is attached to one sandbag (fig. 178).

c. This bag is drawn up clear of ground by taking tension on sash cord or rope, the free end of sash cord or rope is then attached to a second bag (fig. 179).

d. The second bag is then lifted, so that the first bag descends sufficiently to keep the second bag clear of ground.

e. The rungs to which the weight should be attached on these ladders are indicated by the following table:

Length of ladder in feet	*Rungs to which weights are attached*
20	6–8–10–12–14
22	6–8–10–13–16
24	6–8–10–13–16
25	6–9–11–14–17
28	6–9–13–17–21
30	6–10–14–18–22–26
32	7–11–15–19–23–27
35	7–12–16–21–25–30
36	7–12–16–21–26–31
40	8–13–18–23–28–33
50	6–11–16–21–28–33–44

3. Testing Ladder Rungs.

a. The testing of fire department ladders does not end with the determination of their ability to carry a load. The rungs, too, should be submitted to a thorough test.

b. The rung of a ladder may be subjected in service to the combined weight of a fireman and a person being rescued, assuming the weight of each is 175 pounds, the total load on the rung would be 350 pounds. In testing rungs, an allowance of an additional 100 pounds should be made as a safety factor, making the load to which each rung is subjected as 450 pounds. Figure 180 shows proper procedure for this test.

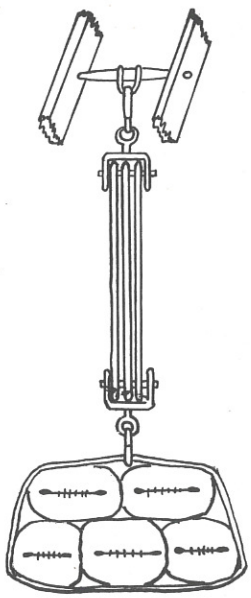

Figure 180.

Chapter 7

FIRE FIGHTING EQUIPMENT AND ITS USE (continued)

SALVAGE

0701. SALVAGE WORK IN THE FIRE SERVICE

1. **Origin.**—The early history of fire service shows that with the organization of fire companies there developed a belief that their function was only to extinguish fires. Later on separate companies were organized, mainly by insurance companies to remove and otherwise save or "salvage" the goods and contents. Through a gradual process of change the salvaging operations at time of fire were dropped for the more spectacular work of hose, engine and ladder companies. In only a few large cities was there any attempt to do this work, and usually only through the support of the fire insurance companies.

2. **Revival.**—The revival of this salvaging work was started in the early 1920's by some of the progressive fire chiefs who realized that in a large percentage of fires the principal damage was from water and smoke, and that the actual fire was small and easily handled by one stream and a few men. The experience was of such phenomenal value to the citizens that other fire departments, including both paid and volunteer, were soon adopting the same practices. Today salvage trained fire departments are the rule instead of the exception.

0702. SALVAGE WORK IN THE NAVY FIRE SERVICE

It is not necessary that separate apparatus be added to the fire department in order to provide for salvage operations. In fact it is a general practice of most cities to carry covers and other salvage appliances on every piece of apparatus. For many years, it was the general view of some fire officials that additional manpower was needed for salvage operations. Navy experience has proved that salvage work is so closely allied with other phases of fire fighting that with proper foresight and training it is not only possible, but is entirely practicable, to carry out salvage work with the men available on the engine and truck companies.

0703. SALVAGE COVERS

1. Navy fire fighting companies should be provided with water resistive, closely-woven duck or rubber coated covers. Salvage covers should be provided as follows: 2 to 4 on each engine company and 4 to 6 on each ladder truck depending on the size, location and classification of the naval activity. Salvage covers, 12 x 18 feet in size, treated cotton duck or rubber coated, as recommended by the National Board of Fire Underwriters Special Interest Bulletin No. 85, are aceptable for Navy use. The National Board of Fire Underwriters Bulletin No. 85 on specifications and acceptance test for these covers is printed in full at the conclusion of this section on Salvage.

2. Every 30 days all folded salvage covers should be opened up and inspected for signs of mildew or sticking.

0704. WATER DAMAGE INCIDENT TO FIRE

1. Effective salvage work during and after a fire will often permit offices, shops and plants to continue in service with practically little interruption. However, damage incident to fire fighting without salvage operations might be such that records, stock and machinery could be destroyed or so damaged as to necessitate a shut-down resulting in loss of time and materials.

2. Unfortunately a considerable proportion of fire loss is due to damage caused by fire department operations. Much of this damage is unavoidable, particularly where fires have reached an advanced stage in highly combustible materials incident to the notification or arrival of the first fighting forces.

3. All too frequently, however, heavy damage is caused by poorly trained, overzealous but well meaning personnel assigned to fire fighting duty, who play hose streams into smoke filled buildings before determining the exact location and extent of a fire. Accordingly it is understandable why fire damage is large and little salvage work is accomplished in areas where the fire companies promiscuously pour tons of water from the street through windows into smoke filled buildings. Such action usually denotes poor leadership and lack of training in the basic fundamentals of fire fighting strategy, tactics and operations.

4. In modern fire fighting practice every effort is made to avoid unnecessary damage. The seat of the fire is located; charged hose lines are strategically brought into place; ventilation is begun and water is applied in the quantity needed on the involved area. Accordingly salvage operations follow. Heavy stream appliances are most frequently needed and used when fire has involved large areas, spread throughout a building and vented itself by breaking through the roof, skylights, and/or windows. Salvage operations should not be entirely forgotten even at fires where heavy hose streams are required and used.

0705. SCOPE OF SALVAGE OPERATIONS

1. Salvage Operations During a Fire May Consist of:

(a) The placing of waterproof covers to protect stock, furniture, fixtures and machinery from water and debris.

(b) The use of waterproof covers to "bag" floors.

(c) Diverting and removing water from a building.

(d) Controlling flow of water from sprinkler systems.

(e) Removing contents where it is not possible to provide protection within a building.

2. Salvage Operations After a Fire May Consist of:

(a) Removing water from floors and basement.

(b) Removing articles of value from debris.

(c) Removing debris from a building.

(d) Drying machinery, furniture, stock, etc.

(e) Restoring sprinkler system to an operative condition.

(f) Providing temporary covering for a damaged roof or other opening to protect interior of a building and its contents from weather.

SALVAGE EQUIPMENT

0706. SALVAGE EQUIPMENT

1. Auger (fig. 27)

A tool for boring holes as a starting point for saws, draining wooden tanks, floors, etc.

2. Caps—Plugs—Nipples

A miscellaneous assortment of plumbing fittings to use for controlling the flow of water, gas or refrigerants from pipes.

3. Claw Hammer

Used in hanging salvage covers and when making temporary repairs to roofs.

4. Corn Broom

For sweeping water and debris.

5. Easy-Out

A tool used to remove male fittings from female connections when purchase on the male fitting cannot be obtained with a wrench.

6. Ejector (fig. 92)

A syphon appliance used for removing large quantities of water from basements, pits, sumps, ships, etc.

7. Floor Runners

Made from waterproof cotton duck, 6 x 18 feet in size. They are carried folded to a 3-foot width and rolled inside of each other for convenience in unrolling on floors, stairways, etc. Their use prevents the tracking of debris on floors and floor coverings.

8. Floor Drain

Made from 4-foot length of 1½-inch pipe flanged on one end and Navy iron pipe thread on the other end for connecting 1½-inch hose to drain water to a distant point.

9. Globe Valve

a. A valve used to temporarily control the flow of water from a sprinkler head outlet when

the main sprinkler control valve cannot be located. The ruptured sprinkler head must be removed from the outlet.

b. The globe valve must be wide open while it is being screwed into the outlet.

10. Guard

Any device used to prevent debris from entering and clogging openings being used as water drains.

11. Hay Hooks

A tool for moving or carrying baled material, packing cases, crates, etc.

12. Ladders

a. Ladders are frequently employed in the construction of water drains of varying types. For this purpose straight ladders are preferable to extension ladders.

b. The 10 foot folding and the 14 foot extension ladders are employed in interiors and confined areas when hanging salvage covers.

13. Lights

a. Members of salvage companies carry flashlights that can be attached to their coat or belt while working, permitting the free use of both hands.

b. Homelight portable generating units and battery operated portable spotlights or floodlights are frequently used when general illumination is desired over a large area.

14. Mops—Buckets—Mop Wringer—Squeegee

For use in removing water from floors and floor coverings.

15. Pike Poles (fig. 38)

Pike poles of varying lengths are used in the construction of and bracing of salvage cover water drains.

16. Roofing Paper

For making temporary repairs to roofs.

17. Rubbish Carriers

Made from waterproofed cotton duck, 5 x 5 feet in size. Handles of rope inserted through pieces of garden hose provide grips which are attached to each of the four corners. They are used to remove plaster, debris, wet sawdust, etc., from interiors.

18. Sawdust

Conforming to certain requirements as to composition, coarseness and water absorbing properties, sawdust is used to absorb water from attics, floors and floor coverings. Dams and dikes of sawdust are employed to control and direct water to a point of drainage.

19. Salvage Chain

Used for hanging and securing salvage covers.

20. Salvage Cord

Used for hanging and securing salvage covers.

21. "S" Hooks—Nails

Used for hanging and securing salvage covers.

22. Salvage Covers

a. Made from cotton duck, rubber coated and 12 x 18 feet in size. For the purpose of hanging and securing, brass grommets are placed conveniently along the edges and at the corners. They are used to protect property, merchandise and furnishings from water damage.

b. "OILASTIC" salvage covers made of heavy canvas duck, thoroughly water-proofed, are also in use in Navy fire departments.

23. Shovels

a. Open scoop shovels are used for spreading and removing sawdust, picking up water, debris, etc.

b. Covered scoop shovels are used for bailing water and picking up wet material. Square point shovels are employed in overhauling operations, removing debris, etc.

24. Smoke Ejector

An electrically operated blower for removing smoke and gases from confined areas.

25. Sponges—Chamois

For removing excess water and drying finished surfaces.

26. Sprinkler Heads

Fused sprinkler heads will be replaced by the fire department or public works department, as the occasion requires, and the Fire Chief will ascertain that sprinkler system is restored to service before leaving premises.

27. Sprinkler Head Shutoff

A device used to temporarily stop the flow of water from a ruptured sprinkler head. With this device it is not necessary to remove the sprinkler head from the outlet.

28. Stillson

A type of wrench designed to grip around objects such as pipes, bars, etc.

SALVAGE OPERATIONS

0707. SALVAGE OPERATIONS

1. Accordion Fold

To permit convenient handling and easy manipulation salvage covers are folded in a regulation manner. Rubber covers must be thoroughly dry and powdered with talc or soapstone before folding.

a. Place cover on a clean surface, finished side up.

b. Apply talc or powdered soapstone to finished side (fig. 181).

Figure 181.

c. Two men take position at opposite ends of cover.

d. Turn all corners in a short distance.

e. Place outside hand flat on ends of cover 3 feet in; with inside hands reach over and grasp corners, then lap over.

f. Repeat operation (e) on opposite side (fig. 182).

g. Place outside hands flat on the border of the two folds in center; reach over with inside hands and fold.

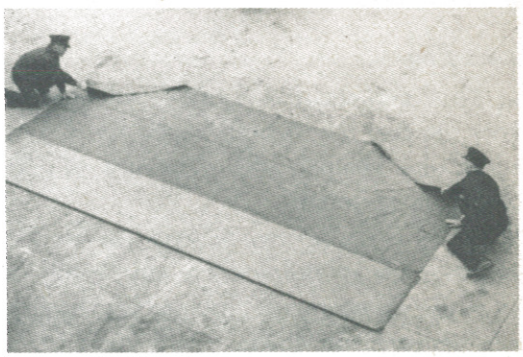

Figure 182.

h. Remove air by pushing 2 floor brushes the length of cover (fig. 183).

i. One man on each side at the same end place their outside hands on edge of cover 8 to 10 inches in.

j. Both men place inside hands opposite each other, palms up under edge of cover 8 to 10 inches from first hands.

Figure 183.

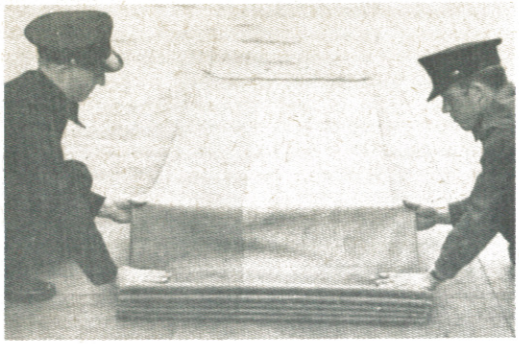

Figure 184.

k. Bring inside hands up and over first hands, making fold; keep all folds even (fig. 184).

2. Carrying

a. This method of carrying a salvage cover allows the free use of both hands for climbing ladders, fire escapes, etc. The use of either shoulder is optional.

b. When carrying two salvage covers at the same time, the second cover is most easily carried on the forearm and hip opposite the shoulder being used (fig. 185).

Figure 185.

c. Grasp end of cover in one hand; balance center of cover in other hand; allow fingers and thumbs to span all folds (fig. 186).

d. Raise and pivot cover over shoulder; maintain grasp on end; adjust cover for balance.

Figure 186.

3. One Man Throw

a. A quick method of covering rolling stock, counters, piles of merchandise and furniture where there is no danger of damage. In making this throw, the use of either arm is optional. The directions given are for a right-handed man.

b. Place center of folded cover over left forearm; grasp bottom fold with thumb and two fingers of left hand; allow remaining fingers to keep tension on fold (fig. 187).

Figure 187.

c. With thumb down, reach in with right hand next to body; grasp 3 or 4 top folds.

d. Swing right arm over right shoulder allowing folds to fall back of right hand (fig. 188).

e. Throw cover as when putting a shot; elevate left arm; retain grip with left hand while throwing (fig. 189).

Figure 188.

f. Unfold cover; allow it to drape over object or material; tuck in cover at bottom to prevent tripping over and to allow water to drain clear of cover.

Figure 189.

4. Counter Pay Off

a. A two-man operation used where conditions require the careful placing of a cover to avoid displacing or damaging goods. Counters or tables displaying fragile merchandise are best covered by this method.

Figure 190.

b. With center of cover next to counter one man holds folded cover with both forearms; grasps bottom fold with both hands (fig. 190).

c. Second man grasps the top fold with both hands; walks backward until the cover is stretched taut. During this operation first man elevates his forearms to hold tension on the cover and to keep it off the floor (fig. 191).

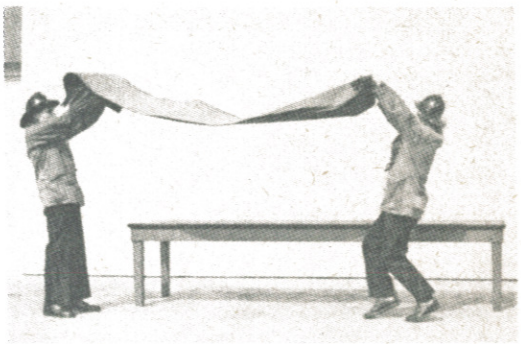

Figure 191.

d. Place cover over counter; lower center fold of cover to center of counter gently.

e. Unfold cover and drape it over the sides of counter (fig. 192).

f. Tuck bottom edges of cover in close to counter to keep aisles free.

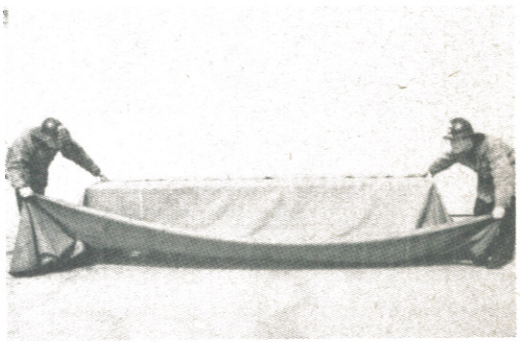

Figure 192.

5. Removing Covers From Counters

a. This method of removal is employed where there is danger of breakage or damage to merchandise stored on counters or where the retention of water and debris on top of covers is desirable.

b. Two men take positions opposite each other at one end of cover.

c. Each man grasps end of cover; raise it clear of counter.

d. Both men grasp ends of cover; raise ends over head clear of counter; walk forward laying raised portion down (fig. 193).

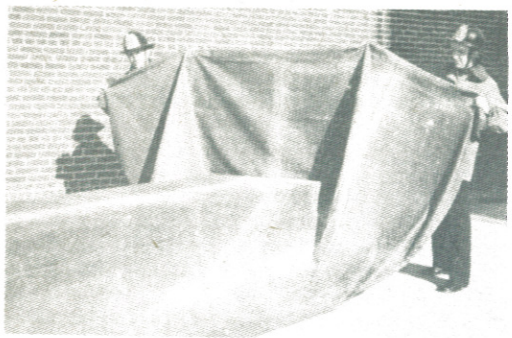

Figure 193.

e. Both men grasp ends and center fold; lap over again; continue making folds until near end of counter (fig. 194).

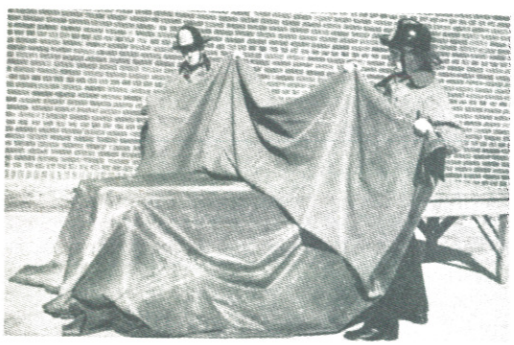

Figure 194.

f. When near end of counter both men grasp other ends of cover and lap over other folds (fig. 195).

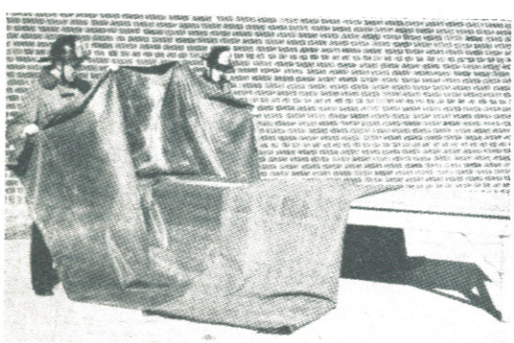

Figure 195.

g. One man places portion of folded cover over his shoulder turning his back to the counter at the same time (fig. 196).

Figure 196.

h. Man on opposite side of counter grasps folds; raises clear of counter; places folds on first man's shoulder, keeping water trapped during process.

6. Two-Man Balloon

a. Used in covering piles of merchandise or objects over which there is plenty of head room to float a cover. This method permits the complete covering of materials with less operations and can be used effectively if the top of the object or material to be covered is within reach.

b. One man holds folded cover with both forearms; grasps bottom folds with both hands.

c. Second man grasps top fold with both hands; walks backward until cover is stretched taut. During this operation the first man elevates his forearms to hold tension on cover.

d. Both men turn cover so the double fold is up and the center of the cover is hanging down.

e. Both men, while holding the cover in one hand, reach in proper distance depending upon object to be covered, grasp double fold with free hands, bring rear hands up even with front hands, then grasp a fold in each hand.

f. Both men pull cover taut; feet well braced; foot next to object back; elbows high; palms down (fig. 197).

g. Both men snap cover up quickly so that air can get underneath forming a balloon; let go with outside hands; float cover over materials with inside hands (fig. 198).

h. Drape cover over object; tuck in at bottom. bottom.

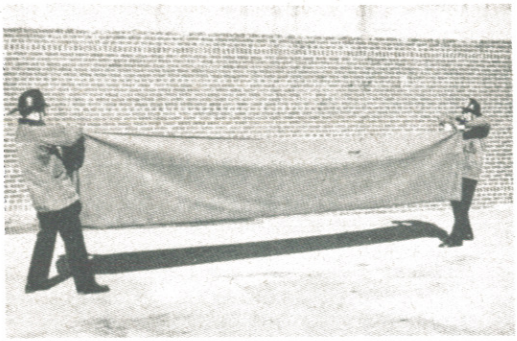

Figure 197.

Figure 198.

7. Sealing

a. Where numerous covers are required to protect large piles of merchandise, it becomes necessary to seal such covers where they overlap. If a proper seal is not made, damage to merchandise may occur by water running between covers.

Figure 199.

b. Turn the end or side of cover already spread back about 1 foot.

c. Grasp adjoining cover; pull it over the 1-foot lap of first cover until edges of cover are even.

d. With men well spaced, all men grasp both edges and roll (fig. 199) until the 1-foot lap is completely rolled.

e. Continue with next set of covers, working in a straight line, repeating operations (b), (c), and (d).

8. Hanging

In protecting merchandise stored on shelves or racks, hang covers by means of salvage cord, chain, "S" hooks or nails placed through the grommets (fig. 200). Weights placed along the top edge of a cover can be used to hold it in place. Where possible, hang covers at a point higher than the shelving. Where shelving extends to the ceiling, fasten covers to the top of shelving. Allow covers to overlap at least 1 foot to prevent water getting through.

Figure 200.

9. Stairway Drain

a. A method of directing water from upper floors to a point of drainage. The number of covers used is dependent upon the length of the stairway. Directions are given for a stairway that would require the use of two salvage covers.

b. One man carries cover to top of stairway; lays cover down; returns to center of stairway.

c. Second man carries cover to foot of stairs, and, using the "One Man Throw," throws cover to man at center of stairway.

d. Both men open cover; secure to handrails or wall with "S" hooks, nails, salvage cord or chain.

e. First man goes to top of stairway; second man goes to center of stairway (fig. 201).

Figure 201.

f. First man, using the "One Man Throw," throws cover to second man.

g. Both men open cover; secure to handrails or wall with "S" hooks, nails, salvage cord or chain.

The upper cover must overlap the lower cover.

The top edge of the upper cover should be placed beneath the lip of the top step. In case the top step has no lip, place sawdust on step, lay cover on sawdust, and bind in place with a cleat (lath).

Sawdust dikes are used to direct water into and away from a "Stairway Drain."

10. Window Drain

a. When leaks are in close proximity to a window, this drain can be used to direct water to the outside of a building.

b. Fasten center grommet of cover to window sill, finished side up; fasten remaining grommets on the same edge of cover to the window frame.

c. Draw cover taut; secure ends and sides by means of "S" hooks, nails, salvage cord or chain under opening in ceiling; allow a light sag so a chute will be formed (fig. 202).

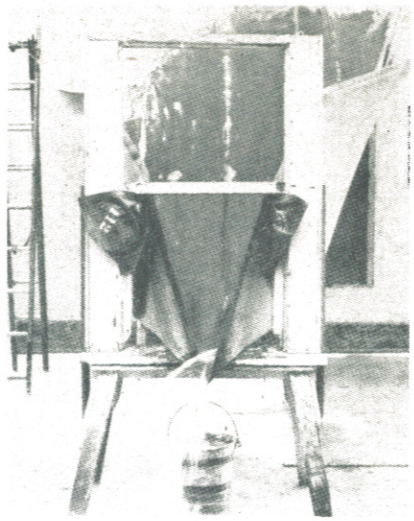

Figure 202.

Pike poles can also be used to support the sides of the cover when making a "Window Drain."

11. Pike Pole Drain

a. This is another method of directing water to the outside of a building when leaks in ceiling are in close proximity to a window.

b. Spread a salvage cover out flat, finished side up.

c. Lay two pike poles along opposite sides or ends at any desired angle; allow handles to extend past cover.

d. Insert points of hooks through top grommets; fold edge of cover down enough to clear hooks.

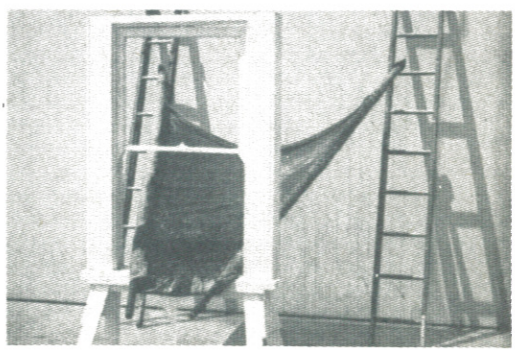

Figure 203.

e. Lap cover over pike poles; roll poles and cover toward the middle until the desired width is reached.

f. Place handle end of drain out of window; fasten upper end by placing pike pole hooks over rung of ladders, pipes, high pieces of furniture or by driving points of pike poles into ceiling (fig. 203).

12. Window Drain With Ladder

a. Where leaks in ceilings occur some distance from a window, this type of drain can be employed to direct water to the outside of a building.

b. Place a straight ladder so one end extends over window sill; fasten.

c. Place other end of ladder under opening in ceiling; support same at an angle by securing it to an improvised step ladder or by placing it on a high piece of furniture.

d. Place a salvage cover, folded accordion width, on straight ladder, parallel with rungs; unfold pleats lengthwise of ladder starting at end extending over window sill (fig. 204).

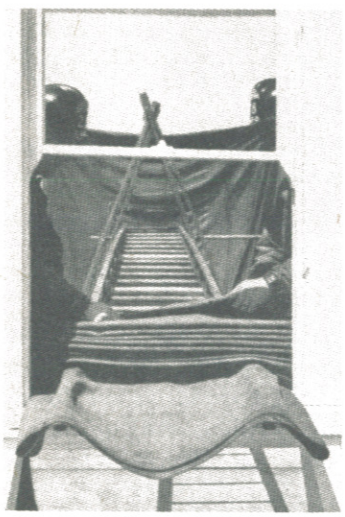

Figure 204.

e. Secure cover to ladder with salvage cord at frequent intervals.

f. If necessary, place second cover in similar manner, allowing it to overlap the first laid cover.

g. Hang third cover by means of "S" hooks, nails, cord or chain to form a chute under opening to guide water into the prepared trough (fig. 205).

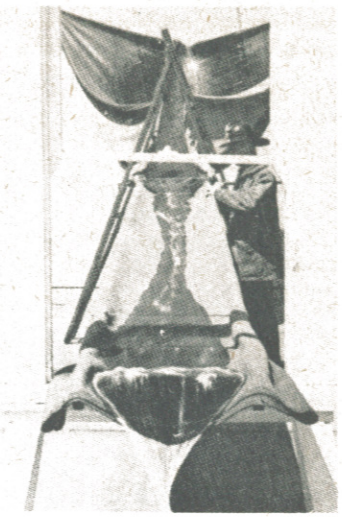

Figure 205.

13. Catch All

a. A method of using a salvage cover to impound water leaking through ceilings that cannot be directed to the outside of a building by means of other improvised drains.

b. Place objects such as chairs, davenports, footstools, benches, etc., in position to form a square or circle.

c. Place cover over assembled material, finished side up; allow center of cover to bag and outer edges to drape over formed square or circle; tuck in at bottom (fig. 206).

Figure 206.

d. A salvage cover can also be held in place by means of "S" hooks, nails, cord, chain or by rolling the edges of the cover and banking them up with sawdust.

e. Water is removed from a "catch all" by syphoning or by bailing with buckets or covered scoop shovels.

14. Sewer Pipes (as drain)

a. Vertical sewer pipes can be utilized to drain excess water from floors or basements.

b. Remove cleanout plug; place guard over opening.

c. If not equipped with a cleanout plug and pipe is exposed, break pipe flush with floor; place guard over opening.

15. Scuppers

a. Scuppers are found in some of the more modern buildings. They are installed at floor level through exterior walls for drainage purposes.

b. If clogged with debris, they can be cleared by poking some object such as a broom handle, spanner, etc., through them.

16. Toilet Bowls (removing)

a. By removing toilet bowls an excellent drain at floor level is provided, particularly where the use of other methods of draining are impractical.

b. Shut off water supply to toilet bowl.

c. Disconnect flush pipe at rear of bowl.

d. Remove nuts from studs at base of bowl.

e. Rock bowl gently to break putty sealed joint at base.

f. Remove bowl; place guard over opening.

17. Washing (covers)

a. Covers that have ben used at a fire or other emergency are thoroughly cleaned and washed before being hung to dry.

b. Spread cover on a clean surface, finished side up.

c. Remove tar or grease with kerosene and scraper.

d. With a stream of water and a corn broom, wash and scrub cover thoroughly.

e. Fold cover one-half width; wash top side.

f. Fold cover one-fourth width; wash top side.

g. Fold cover one-eighth width; wash top side.

h. Turn one-third of folded cover in lengthwise; wash.

i. Roll folded cover lengthwise washing it as you progress.

j. Hang washed cover on rack to dry.

k. This method of folding is commonly referred to as a "WET FOLD." It can be used to advantage when picking up covers at the scene of a fire or other emergency. It offers a convenient way of carrying them back to company quarters.

18. Repairing Rubber Coated Covers

a. Small cuts, tears and holes burned in salvaged covers are repaired in the following manner:

b. Place dry cover on flat surface, finished side up.

c. Trim off ragged edges of damaged area.

d. Prepare the surface with a buffer or sandpaper about three-fourths inch from edge of hole or tear.

e. Wipe the buffed surface.

f. Cut prepared patching material a little larger than hole or tear; avoid sharp corners.

g. Apply a coat of rubber cement to the buffed surface; allow it to dry until it becomes tacky to touch.

h. Remove protector cloth from prepared side of patching material; keep fingers off tacky surface; apply patch to hole or tear; roll with roller to prevent wrinkles and to insure good contact.

0708. SPECIFICATIONS FOR SALVAGE COVERS

National Board of Fire Underwriters, 85 John Street, New York City, N. Y.

Special Interest Fire Department Bulletin No. 85.

1. Salvage Covers.

The value of salvage work depends upon the quality of the cover. Most of those in service are made of treated cotton duck, but some covers having a rubber coating have been used. The following specifications are designed to permit bids being obtained with either type of cover.

2. Specifications for Salvage Covers.

SIZE: Either 12 x 18 or 14 x 18 feet, tolerance 3 inches plus or 2 inches minus in either width or length, or both. Cloth to be cut 19 feet.

COTTON FABRIC.—To be of clean cotton duck, free of knots, dropped threads or other weaving imperfections. The weave of the fabric or count of the warp and filling threads per inch and the strength shall be in accordance with the requirements of Federal Specification No. CCC–D–771.

TREATED COTTON DUCK COVER.—Fabric to weigh not less than 11 ounces per square yard before water-

proofing, and not more than 20 ounces per square yard after waterproofing. To be treated with a preparation that will produce a waterproof condition capable of withstanding tests hereinafter specified. The treatment to be such that the covers will not mildew, stiffen in cold weather, nor become tacky in warm weather.

Seams to be not more than 2 in number, and each seam to be sewed with 2 lines of stitches on lock-stitch machine with rotproofed and waterproofed thread. All seams to measure from three-fourths to 1 inch between lines of stitches and to be of the "roll" type with edges turned under, and so treated as to prevent leakage at that point, as provided for in the tests hereinafter specified.

All edges shall be hemmed by turning under 1½ inches of goods, so as to make 3 thicknesses of goods all around the edge of the cover.

RUBBER COATED COVER.—The finished weight of a cover frictioned both sides shall not be less than 24 pounds nor more than 33 pounds per cover. Fabric to weigh not less than 7½ ounces per square yard. The strength of the warp or filling shall be not less than 100 pounds per inch of width in warp and 70 pounds in the fill.

Covers frictioned both sides shall have a coating weighing not less than 7.5 ounces per square yard and not more than 12 ounces per square yard.

The rubber to be black, bloomed finish, without varnish or other wash. The first application or friction coat shall be calendered and penetrate into the interstices of the weave, showing through on the reverse side. The finished cover shall be free from surface imperfections.

These covers as stored for use will be so folded as to create many angles, corners and folds. The rubber coating must not crack, check or peel, due to this folding.

Seams shall not be more than two in number and must not be butted, but must be lapped not less than 1 inch and are to be in the direction of the greatest length of the cover. All seams are to be cemented.

All edges shall be hemmed by turning back the fabric on itself for a distance of 1¼ inches, and be cemented in place.

GROMMETS.—The 12 x 18-foot cover shall have 24 No. 3 spur brass grommets spaced 2 at each corner, five at each side and 3 at each end. The 14 x 18-foot size shall have 32 of these grommets, spaced 2 at each corner, 7 at each side and 5 at each end.

GROMMET REINFORCEMENTS.—All corners to be reinforced on the under side of cover with 7½-inch triangular pieces of the same material as that used in body of cover so as to provide 3 thicknesses of goods for corner grommets.

STENCIL.—Covers are to be stenciled with the month, day and year on two opposite corners in 3-inch letters. Eight-inch letters designating Fire Department, Fire Patrol, or other organization, at direction of purchaser, to be placed at opposite corners.

TESTS.—Not less than 20 percent of all deliveries to be tested as follows:

Covers to be picked at random and placed in a test rack hereinafter described, and there subjected to a depth of 5 inches of water over the seam for a period of 4 hours. No drop shall appear in the fabric, and leakage in excess of one-fourth ounce of water at the seam during the test period shall be cause for rejection. If one cover fails, all covers in the assignment shall be tested.

TEST RACK.—To be made of two pieces of 2 x 4's each 16 feet in length, with 2 cross pieces of same material 2½ feet long. Holes for thumb-screw bolts to be drilled 6 inches from ends of each 16-foot piece, and 1½ inches in from ends of each 2½-foot piece. In testing, cover is to be spread out on floor, black side up, and each end folded back 2 feet. Each side is then rolled up on 1 of the 16-foot 2 x 4's to within about 15 inches of one of the seams, so this seam will be at the middle of the rack. The two 2½-foot 2 x 4's are then fastened to the longer pieces by means of the thumbscrews and the rack and cover are raised off the floor high enough to permit observation of the test. Water to a depth of 5 inches is then poured into this trough. The folds at the ends of cover prevent water from spilling while test is in progress.

LAKE TEST.—Using the test rack described above, place rack on top of bricks, or some other object, so as to raise rack to a height of about 8 inches off the floor. Spread cover out flat, black side up, and press cover down over rack, with seam at middle, until cover is flat on floor, thus forming a rectangular trough, or lake basin, into which water is to be poured to a depth of 5 inches. After 24 hours, with cover resting on floor, there shall be no leakage.

WARRANTY.—The contractor shall warrant all covers furnished under these specifications to be waterproof and to meet the test requirements, and shall agree to replace any cover which, within a period of 13 months after the month and year indicated by the corner stencil, develops defects resulting from imperfections in manufacture or waterproofing.

QUOTATIONS.—Quotations shall be understood as applying to these specifications.

TERMS.—Terms to be 2 percent 10 or net 30 days from date of shipment, f. o. b. shipping point. Freight paid prices quoted on request.

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